SCIENTIFIC AMERICAN

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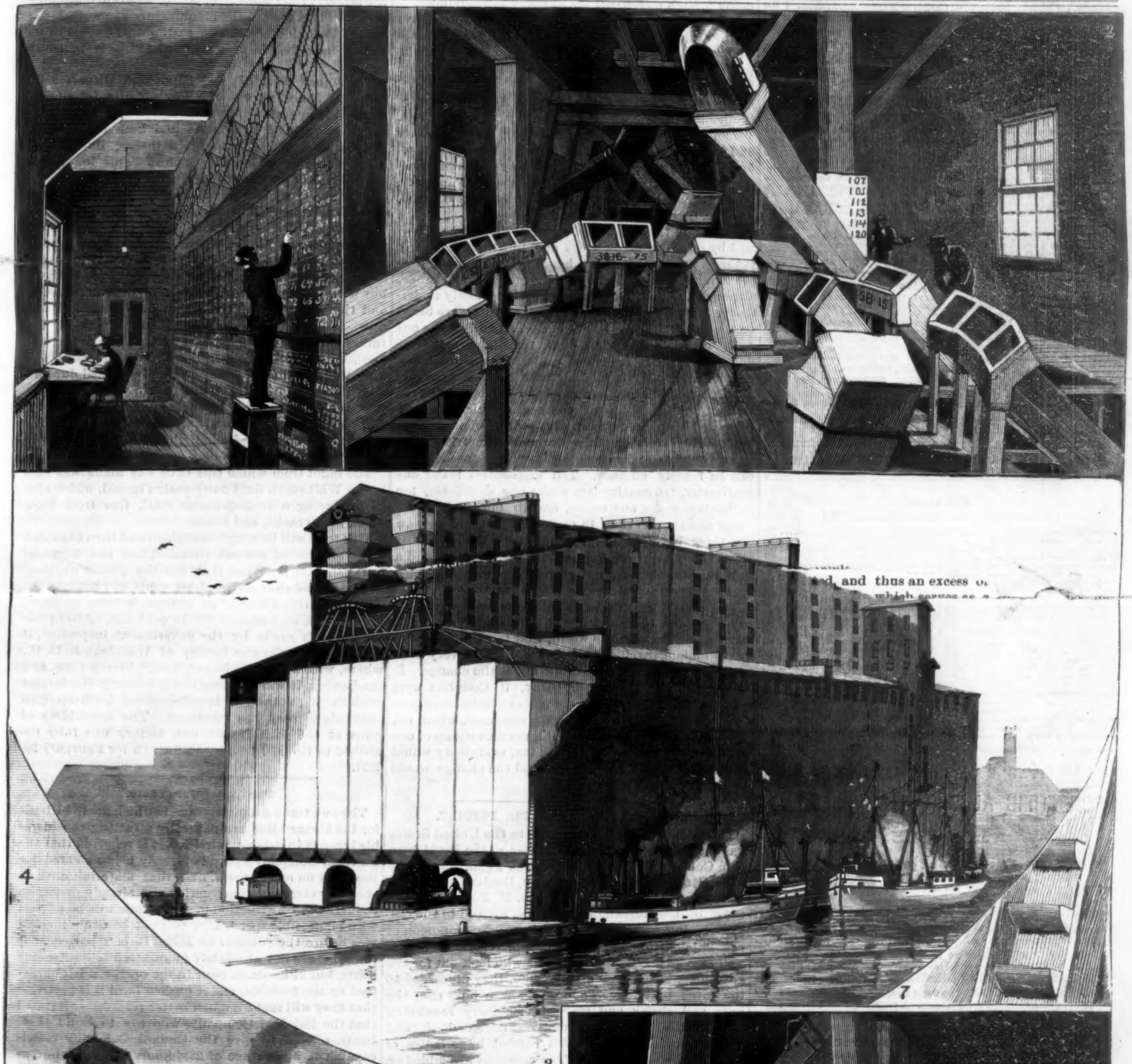

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NEW YORK, SATURDAY, OCTOBER 24, 1891.

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(Illustrated articles are marked with an asterisk.)

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For the Week Ending October 24, 1891.

Price 10 cents. For sale by all newsdealers.

RELATIONS OF FOREIGN TRADE TO THE METRIC SYSTEM.

Several British consuls have recently warned their countrymen they were losing considerable trade in foreign countries owing to their persistent use of English weights and measures in their circulars and price lists, which were perfectly unintelligible to most of the foreign dealers, whereas their French, German, and other competitors used the metric system, which was familiar to everybody, and naturally attracted custom.

The consuls have declared that the British manufacturers are simply playing into the hands of their rivals by persisting in the use of figures which to many foreign merchants are so many hieroglyphics.

These warnings apply equally well to the exporters of the United States, and for their further guidance we here subjoin an alphabetically arranged list of the principal foreign countries in which the metric system is now used:

Algeria, Argentine Confederation, Austria-Hungary (Bohemia), Belgium, Brazil, Canary Islands, Chile, Colombia, Cuba, Denmark, Ecuador, Egypt, France and colonies, Germany and colonies, Greece, Guatemala, Honduras, Iceland, Italy, Malaga, Manila, Mexico, Mozambique, Netherlands, Norway, Paraguay, Peru, Portugal, Russia, Turkey, Spain and colonies, Sweden, Switzerland, Venezuela.

The use of the metric or decimal system was authorized by our laws many years ago, but the use has not yet been made compulsory, hence the majority of people cling to the old system and dislike to change, although the metric is more simple and easily understood. Our coins and monetary calculations are based on the decimal or metric system. Ten mills make one cent, ten cents make one dime, ten dimes make one dollar, ten dollars make one eagle. This is plain and simple, everybody is familiar with it, and probably nothing could induce our people to go back to the old style of pounds, shillings, and pence, which formerly prevailed in this country, and is still current in England. The extension of the decimal or metric system to our weights and measures is urgently needed and can be readily effected. Ten millimeters make one centimeter, ten centimeters make one decimeter, ten decimeters make one meter, and so on. This is far easier and simpler than to reckon measures as we now do, three barleycorns make one inch, twelve inches make one foot, three feet make one yard, five and a half yards make one rod, forty rods make one furlong, eight furlongs make one mile, and so on.

The metric system is so much more convenient, saves so much time, and has now become so generally adopted throughout the world, that the United States ought no longer refuse to fall into line. A very little pressure would suffice to bring about the change. It would do the business, probably, if Congress were simply to pass a law requiring that estimates, contracts and bills, specifying weights or measures, when not made out metrically, must bear a revenue stamp of one dime. Rather than pay a small tax, everybody would at once use the decimal system, and the change would be as smooth as the system itself.

LARGE CASTING AND LARGE FORGING.

The largest casting ever made in the United States was poured on the 13th of October, at the Bethlehem Iron Company's Works, Bethlehem, Penn.

The Hon. Secretary of the Navy, Benjamin F. Tracy, accompanied by Commodore Wm. M. Folger, U.S.N., Chief of the Bureau of Ordnance, arrived in the city the evening of the 12th, and during the forenoon of the 13th, surrounded by the officials of the works, as well as the two naval lieutenants who look out for the government's interests at this place, they proceeded to the forge building. The scene was a busy one; the hum and shriek and roar of machinery re-echoing through the works. Locomotives darted back and forth, drawing trucks which carried huge ladles of white-hot, molten metal. The company assembled on the platform of the open-hearth furnaces to witness the pouring.

The mould had been prepared by digging a large pit and lining it with an iron bottom, to support the great weight of the casting. The patterns had been placed and well packed with moulding sand, and, when they had been withdrawn, the mould was braced in every conceivable direction by tie rods and braces. The top of the mould came just even with the floor of the building, and was thoroughly packed in with dirt, and all leveled off. Along this dirt floor were various troughs of iron, lined with composition.

At each end of the mould stood an immense ladle, containing over forty tons of molten metal. To one side was the railroad track, on which, by the aid of five locomotives, were drawn the twelve trucks, each truck carrying a ladle containing about nine tons of molten metal. When these twelve ladles were in place, in front of each could be seen a trough leading to the mould. On signal from Mr. John Fritz, the general manager, the two large forty-ton ladles were started, by side tapping, and two large streams of molten metal roared toward the mouth of the mould. A moment later, and each of the twelve truck ladles tilted forward and poured their tribute into their troughs, and thence into the mould.

The fourteen streams of bright metal, the glowing tops of the ladles, and the showers on showers of sparks made a brilliant sight in the gloomy foundry. Not an accident occurred, not a moment's delay marred the proceeding, so well planned was the undertaking, so carefully had each item been looked after.

The finished casting will weigh about 330,000 lb., or about one hundred and fifty tons. Of course much more metal than this was poured to allow for sinking heads, troughs, and overflows. This is the largest casting ever made in the United States and probably the largest in the world. It is to be a part of a machine which will be used in the manufacture of war material for the United States. The casting will be left in its mould for a couple of weeks or until it is perfectly cooled.

The second event of great importance witnessed by the Hon. Secretary was the forging of a tube for a thirteen inch gun.

The compressed steel ingot had been bored to an internal diameter of about ten inches, its external diameter being about fifty inches. This ingot had been placed in the gas heating furnace and when taken out it was of a good welding heat. A mandrel had been placed through it and each end of the mandrel was supported by a chain hanging from a hydraulic traveling crane. These cranes, moving foward, soon brought the ingot under the large No. 1 Whitworth forging press. The ram of the press descended slowly, but with the force of many tons of hydraulic pressure, and the hot steel of the ingot gave way and was pressed down. The ram lifted and the ingot was turned or rotated slightly. The pressure was again applied, and so, stroke after stroke, the steel was kneaded, and the ingot was gradually worked down to a long tube. This tube in the rough, when it left the press, was about twenty-six inches in external diameter and eleven inches in internal diameter, thus leaving walls about seven and a half inches in thickness. It is about forty-two feet long.

The ingot from which this tube was made was cast in the Whitworth fluid compression mould, which aids in producing a homogeneous steel, free from blow holes, pits, cracks, and seams.

This tube will be rough-machined and then annealed and oil-tempered several times. Then test bars will be taken from it to see if it has the proper physical qualities, and chemical analyses made of specimens to determine the amount of carbon, silicon, sulphur, phosphorus, and manganese it contains. After passing the tests made by the government inspectors, it will be sent to the gun factory at Washington, D. C., where, with a suitable jacket, hoops, breech plug, and mechanism, it will be assembled, forming the largest modern high-powered breech-loading built-up gun that this country has produced. The assembling of guns at the Washington gun factory was fully described in the SCIENTIFIC AMERICAN for February 28, 1891.

The New Cunarders.

The new trans-Atlantic steamers which are to be built for the Cunard line are naturally attracting considerable interest in shipping circles. It is reported that the Fairfield Company's yard is already being cleared for the work on one of them, and that materials used in the early stages of construction are already prepared; though the construction of the vessels will be pushed with all possible speed, they will not be ready for service before the summer of 1893. It is reported that the ships are not absolutely guaranteed to be five-day boats, but 21 knots an hour in the open sea is guaranteed by the builders, and if pushed hard it is probable that they will make a much better record. It is stated that the Fairfield Company, who are to build these boats, offered to give the Cunard Company vessels capable of an average of 22½ knots per hour, but, as considerable space for the accommodation of first-class passengers would have to be sacrificed in order to obtain this speed, the Cunard Company decided to be satisfied with a little less speed and a better-paying boat. Provisions have been made in the design for the accommodation of 600 first-class passengers, nearly a third more than the Teutonic or Majestic.

White Cement.

White cement of the same character as Portland cement is made by grinding together three parts of chalk and one of kaolin, burning at a red heat and grinding again. The cement made by this process hitherto has shown a tensile strength only about one-half as great as that of good Portland cement, but it has the hydraulic quality and other characteristics of Portland cement, and it is to be hoped that the manufacture may be so improved as to increase the tensile strength to the point required for making artificial stone. If a white cement can be found for a matrix it will be easy to obtain aggregates of light color by utilizing white sand, marble dust, white talc, and so on, suitable for making a concrete which could be used in place of marble.

How Toilet Soaps are Made in Germany.

Owing to the different conditions of the oil market in Europe as compared to America, the raw materials for the soaps made there are somewhat differently regarded in Germany than here. Cocoanut oil and palmkernel oil largely predominate there, while wool fat, linseed oil, horse fat, and recovered greases are given special attention in connection with the many problems which confront the German manufacturer in regard to the proper procedure in the many soaps which he makes on a small scale. For it must be understood that there the number of even comparatively large factories is exceedingly small when compared to that of the very small factories that make their boiled soaps in batches of 3,000 to 4,000 lb. or less, in a kettle heated by an open fire, and with hardly as much as an indistinct recollection of having heard that in some parts of the world soap is crutched by machinery. Besides the difference in the raw materials used mostly, and the small scale on which the German manufacturer generally operates, there is also the difference in climate as well as of usage and popular taste, which calls for one kind of soap in one country and for other kinds elsewhere; so, for instance, boiled-down soaps are used to a much greater extent in Europe than they are here, and again, as owing to their moist climate soaps dry less rapidly than they do here, such kinds are greatly made as would prove almost insoluble in our climate after storing for some time. Then, too, soft soaps are made in Germany in incredible quantities.

But, to come to our subject of toilet soaps. It will be seen from the following description by Dr. Bering, a German soap manufacturer, that in the matter of toilet soaps the difference between the countries is less marked, only that they make a much larger proportion of their toilet soaps by the cold process. In a detailed description of the process, Dr. Bering writes the following, from which some of our readers can perhaps gain a useful wrinkle or two:

The soaps turned out by our perfumers are made either directly or indirectly by remelting or by milling. In the two last named processes soda soaps are used which must be free from odor and perfectly neutral, must be easily melted on heating, and—in spite of greater solubility—must yield a more abundant and solid lather than the boiled soaps. [We presume the author meant to say "the ordinary boiled soaps," since the remelted and the milled soaps are most generally boiled soaps.—Ed. *A. S. J.*]

In the first named process the fats are melted at the lowest possible temperature, not above 65° R., and one-half of the lye to be used, at sp. gr. 1·33, is run in while stirring steadily; after one-half to one hour, according as the mass shows a tendency to become solid, the remaining lye is added, and when the mass appears to be perfectly homogeneous throughout, the color and perfume are stirred in. Now the soap is run into rather strong wooden frames which are covered inside with linen cloths of a close texture, and sufficiently large that the entire block of soap can be covered with them. The square forms consist of side pieces about 1½ to 2 feet long and 1 inch thick, and a bottom of the same thickness. The side pieces are provided with pegs that fit exactly into corresponding holes in the bottom and walls, so that they can be easily put up or taken apart. Iron braces resting in notches on the side pieces give the frames the necessary strength to hold the batch of soap of say 1 cwt. After framing the soap, the whole is covered with thick cloths in order to keep in the heat which develops. As soon as the soap has become solid the cloths are removed, the soap is allowed to get cold, the side pieces are then taken off and the linen cloth is removed off. The soap is now ready for cutting and pressing, care being taken to warm the bars previously if they have become too hard, in order to avoid cracking. After pressing the cakes are trimmed in order to remove any unevenness on the edges.

The fats used are lard, tallow, cocoanut oil, palm oil, and less frequently almond oil. The lard and tallow must be previously purified, and especially the latter has to be freed of its disagreeable odor. In running the melted grease into the kettle it is passed through a cloth. The manner of adding the color depends on the nature of the latter, heavy, earthy, or metallic colors, such as umber or vermilion, being added only when the soap has acquired a thick consistency, while dissolved colors may be added while the soap is still thin. Very few colors only can be added before all the lye has been run in and saponification has begun. Aniline colors almost disappear at first under the action of the alkali, but return after cooling.

Marbling of the soap is done by stirring up the required color in melted cocoanut oil, running it into a funnel closed at the lower end by a finger, and letting the contents run over the soap as it is run in layers into the frame. When the frame is full a stick is drawn in fancy figures through the soap to distribute the color.

Practice is the best teacher, not only in the use of different fats, whether cocoanut oil alone, or with tallow or lard, or with both, is to be employed, but also in deciding whether soda lye alone shall be used or potash lye added to it. Those who work intelligently will soon find which will bring them to the result they desire.

The second process, remelting, which is largely practiced in England, consists in finely chipping the tallow soap procured from the soap maker, melting it over a very slow fire while steadily stirring, adding the perfume, mixing well, and framing. If a soap smells too strongly of tallow it may be purified by melting it over a very slow fire or in a water bath, together with one-third its weight of water, preferably rose water, and adding a small quantity of salt to separate the soap again; run it through a sieve, as close as possible, and let cool. Repeat if necessary.

In the matter of soap, of course, cheap goods are always wanted and the demand was supplied by incorporating more and more water in the soap. Cocoanut oil soap is especially adapted for this purpose, not only taking up considerable water itself, but communicating the same property to other fats. Such soaps, however, by the evaporation of the water, soon lose their shape and appearance.—*Amer. Soap Jour.*

Horticulture Industries.

Census Bulletin, No. 109, contains a preliminary report, prepared by Mr. J. H. Hale, special agent, under the direction of Mr. Mortimer Whitehead, special agent in charge of horticulture, upon the nursery industry of the United States, which has for the first time been made a subject of census investigation. The material from which these statistics are compiled was obtained direct from the nurserymen, upon schedules specially prepared for that purpose, and by personal visits of special agents to nursery establishments in all parts of the country. These figures are subject to revision before publication in the final report.

From the tabulations in this bulletin it appears that there are in the United States 4,510 nurseries, valued at $41,978,835.80 and occupying 172,806 acres of land, with an invested capital of $52,425,669.51 and giving employment to 45,657 men, 2,279 women, and 14,200 animals, using in the propagation and cultivation of trees and plants $990,606.04 worth of implements. Of the acreage in nurseries, 95,025·42 were found to be used in growing trees, plants, shrubs, and vines of all ages; and the figures based upon the best estimate of the nurserymen make the grand total of plants and trees 3,386,855,778, of which 518,016,612 are fruit trees, 685,603,396 grapevines and small fruits, and the balance nut, deciduous, and evergreen trees, hardy shrubs, and roses. The largest acreage is devoted to the production of apple trees, viz., 20,232·75 acres, numbering 240,570,666 young trees, giving an average of 11,890 per acre, while the plum, pear, and peach have, respectively, 7,826·5, 6,854·25 and 3,357 acres, producing 88,494,367, 77,223,402, and 49,887,894 young trees, or an average of 11,307, 11,266, and 14,861 trees to the acre.

Horticulture has been making wondrous strides in this country during the last quarter of a century.

While most of the first trees and plants were of necessity brought from the mother country by the early settlers, their production from seeds and by budding, grafting, and layering was begun here early in the seventeenth century, as shown by many of the early colonial records.

Food before Sleep.

Many persons, though not actually sick, keep below par in strength and general tone, and I am of the opinion that fasting during the long interval between supper and breakfast, and especially the complete emptiness of the stomach during sleep, adds greatly to the amount of emaciation, sleeplessness, and general weakness we so often meet.

Physiology teaches that in the body there is a perpetual disintegration of tissue, sleeping or waking; it is therefore logical to believe that the supply of nourishment should be somewhat continuous, especially in those who are below par, if we would counteract their emaciation and lowered degree of vitality; and as bodily exercise is suspended during sleep, with wear and tear correspondingly diminished, while digestion, assimilation, and nutritive activity continue as usual, the food furnished during this period adds more than is destroyed, and increased weight and improved general vigor is the result.

All beings except man are governed by natural instinct, and every being with a stomach, except man, eats before sleep, and even the human infant, guided by the same instinct, sucks frequently day and night, and if its stomach is empty for any prolonged period, it cries long and loud.

Digestion requires no interval of rest, and if the amount of food during the twenty-four hours is, in quantity and quality, not beyond the physiological limit, it makes no hurtful difference to the stomach how few or how short are the intervals between eating, but it does make a vast difference in the weak and emaciated one's welfare to have a modicum of food in the stomach during the time of sleep, that, instead of being consumed by bodily action, it may during the interval improve the lowered system; and I am fully satisfied that were the weakly, the emaciated, and the sleepless to nightly take a light lunch or meal of simple, nutritious food before going to bed for a prolonged period, nine in ten of them would be thereby lifted into a better standard of health.

In my specialty (nose and throat), I encounter cases that, in addition to local and constitutional treatment, need an increase of nutritious food, and I find that by directing a bowl of bread and milk, or a mug of beer and a few biscuits, or a saucer of oatmeal and cream before going to bed, for a few months, a surprising increase in weight, strength, and general tone results; on the contrary, persons who are too stout or plethoric should follow an opposite course.—*Dr. Wm. T. Cathell, in the Maryland Med. Jour.*

Process of Sizing Paper.

The advantage of using aluminate of soda for saponifying the rosin used for size, instead of soda ash or caustic soda, is said to lie in the fact that in filling the paper its alumina serves the same purpose as the alumina of the alum generally used, rendering it practicable to dispense with alum entirely, and in the case of its use together with aluminate of soda giving an excess of alumina, which is a valuable addition to the pulp at this stage of its manufacture. The further advantage of using soluble salts of magnesia and calcium instead of alum to decompose the rosin soap is that these salts are neutral, while alum is acid, that they are cheaper than alum, and in case of the magnesia salts the precipitated magnesia is a valuable addition to the pulp.

A new method of precipitating alumina in the pulp in the beating engine is closely allied to this process and consists in adding aluminate of soda to the saponaceous solution of rosin mixed with pulp, together with the sulphate or chloride of magnesia, the chloride of calcium or the sulphate of alumina used to precipitate the rosin from the soap and form with it the sizing compound. Where these substances are used in solution they should be added separately.

The sulphuric or hydrochloric acid of the above-named salts will combine with the soda resinate or soap, freeing the resin acids (pinic, abietic and sylvic), and also with the soda of the aluminate of soda, precipitating the alumina; at the same time the magnesia, lime or alumina of the sulphate or chloride used is precipitated, and thus an excess of alumina or magnesium aluminate which serves as a filler, besides the size formed from the resin in the usual way, is secured.

The reactions incident to the process may be given as follows: $2NaR + 2NaAlO_2 + 2MgSO_4 = 2Na_2SO_4 + MgR_2 + MgAl_2O_4$; and when aluminum sulphate is used, $12NaR + 6NaAlO_2 + 3Al_2(SO_4)_3 + 12H_2O = 9Na_2SO_4 + 4AlR_3 + 4Al_2O_3 + (12H_2O)$.

Remedy for Phylloxera.

The introduction of American plants to replace those destroyed by parasites in French vineyards has not arrested the use of insecticides for the protection of French vines still attacked by *Phylloxera*, and for this purpose carbon bisulphide (either pure or dissolved in water), sulpho-carbonates, and submersion continue to be employed with more or less success. The carbon bisulphide is by far the more efficient, but is too volatile and does not diffuse with sufficient rapidity. When, however, it is mixed with vaseline, its volatility is reduced and its diffusibility is increased, the former proving advantageous in light and calcareous soils, the latter in heavy soils, in accordance with theoretical considerations. The vaselined sulphide is applied in the same way as the ordinary sulphide, depositing some at the foot of the vine stock and spreading the rest over the surface; this treatment is found to be effectual; with it *Phylloxera* is no longer seen in the roots, vegetation is luxuriant, and numerous new rootlets indicate a decisive increase in vitality; the manuring on a test tract of land had not been altered for six years, therefore the improvement was solely due to the insecticide.—*P. Cazeneuve.*

A New Local Anæsthetic.

Dr. C. Redard, Clinical Professor at the Geneva School of Dentistry, speaks highly of chloride of ethyl as a local anæsthetic. It is a colorless, mobile liquid, having a peculiar and pleasant odor and a sweetish burning taste. Its sp. gr. is 0·9214. It is slightly soluble in water, but dissolves readily in alcohol. It is sent out for medicinal use in hermetically sealed glass tubes containing a little more than two drachms each. When required for use the point of the tube is snipped off, and the warmth of the operator's hand is sufficient to cause a very fine jet of the chloride to be projected on the part to be anæsthetized. Up to the present its use has been confined to dentistry and as an external application in neuralgic affections, but there is little doubt that in a short time its value will be tested in general surgery. Its action is similar to that of methyl chloride.

TRANSPORTATION OF GRAIN IN THE UNITED STATES.

The immense grain crop of the present year has attracted much attention. It is believed that the subject of the transportation of the vast quantity of grain of all kinds will be of interest to our readers.

The Armour Elevator Co., of Chicago, Ill., one of whose elevators forms the subject of the illustrations accompanying the present article, is a representative company. They possess a number of these structures, with an aggregate storage capacity of nine millions of bushels of grain. In a working day fifteen hundred cars can be unloaded, and in an hour about 300,000 bushels can be loaded into cars or vessels. The different elevators are designated by letters extending up to F. They receive grain from the Chicago, Milwaukee, and St. Paul and the Chicago, Burlington and Quincy Railroads. An immense area of country is tributary to these lines, the first named representing 6,064 miles and the last named 6,295 miles of road. Through these lines North and South Dakota, Minnesota, Wisconsin, Illinois, Indiana, Iowa, Nebraska, Kansas, and Missouri are drained to the great center of distribution where these elevators are situated. Even Texan grain reaches them *en route* to the East and to Europe.

An interesting shipment occurred in August last, when the elevator illustrated in the cuts received a cargo of wheat by special train from the newly settled Oklahoma. This was the first shipment of wheat to the North from that region.

The same company have a line of grain propellers plying on the lakes, and own 2,500 cars devoted to transporting grain.

The elevator known as elevators A and B, receiving grain from the St. Paul road, is the largest elevator in the world under a single roof. Elevator D and its annex belonging to the Armour Company surpass it in capacity, but are not a single unbroken structure. It is rated at a storage capacity of 2,500,000 bushels, can unload 500 cars per day and deliver 100,000 bushels per hour to cars and boats. Cars enough to keep it at work for four days can be accommodated in the great yard annexed to it. The building proper is 550 feet long and 156 feet high. An engine of 1,200 horse power is employed in driving the elevating belts.

The general features of its construction are the following. It comprises a main building surmounted by what is termed the cupola. The main driving engine is situated on about the ground level, at one end of the building. Along the top of the cupola a counter-shaft, the full length of the building, is carried. This is driven by the engine. The main belt is of India rubber and canvas, eight ply in thickness and sixty inches wide. This runs very nearly vertically from the engine driving pulley to the pulley on the countershaft, one hundred and fifty feet above it. All along the countershafts are the driving pulleys for working the twenty-eight elevator belts. These belts are made also of India rubber belting, and carry steel buckets riveted at regular intervals along their outside face. As the belt travels up on one side it carries up full buckets. At the top these pass over the driving pulley and are emptied as they turn over, and then they descend empty on the other side of the belt. From the point of delivery of the belt the grain passes by gravity through inclined chutes to the main body of the elevator, and is directed by one or the other of the chutes to any desired point. Fig. 7 shows a portion of an elevator belt, with the buckets on the ascending side of the belt.

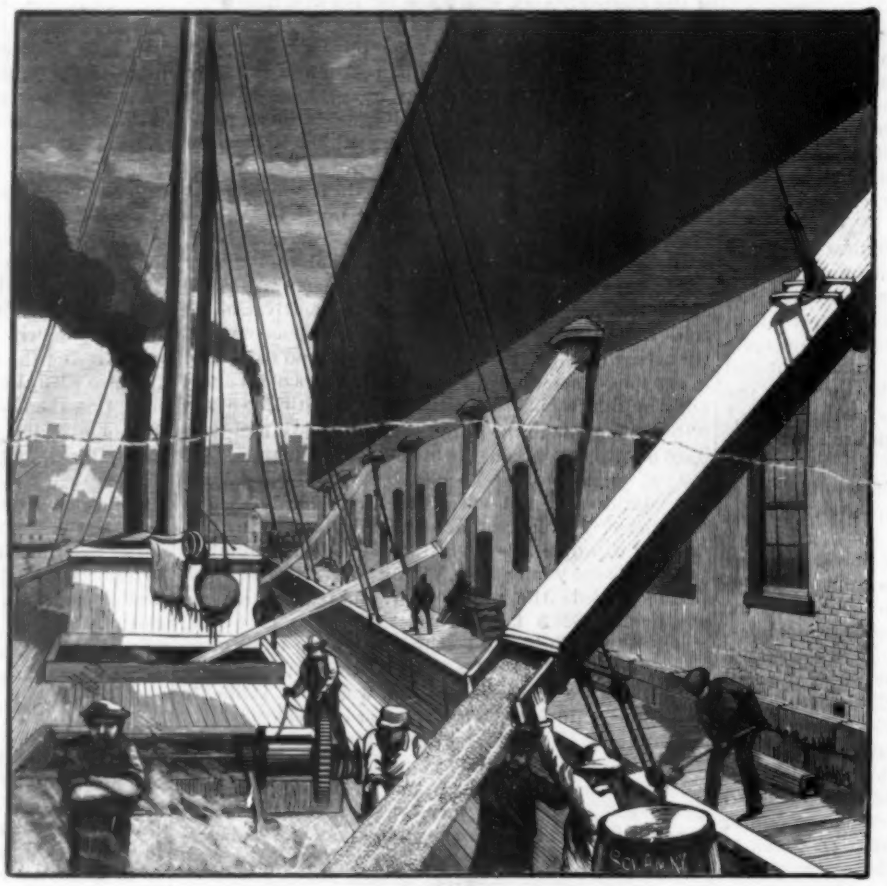
The grain from the elevating belt falls into the mouth of a chute which rotates on a vertical axis, whose prolongation would pass through its receiving end or mouth. Thus, when swung around on its pivot, its receiving mouth remains unchanged in position. The open ends of a number of chutes leading to the garners corresponding to respective bins below are arranged in a circle around the revolving chute or "revolver." Each is numbered in accordance with the bin it leads to. The revolver can be swung so as to connect with any one of these. In this way one elevator is made to feed a number of bins. The arrangement is shown in Fig. 2 and can also be seen in Fig. 3.

Below the chutes on the next floor are what are known as and have just been referred to as garners. These are simply square bins holding 1,000 bushels each. Immediately under each is a platform scale with its bin of the same size as the garner above it, and receiving grain from the garner, when desired. Here the grain is weighed. The garner, it will be seen, can receive grain during the operations of weighing and discharging the weighing bin, and when the latter is emptied can at once refill it. In Fig. 3 the garners and weighing bins are shown. In Fig. 6 one of the scales and weighing bins is illustrated. A hand hole is provided for each weighing bin whence samples can be drawn. This is shown also in Fig. 6.

From each weighing bin the grain is delivered into the bins and pockets that completely fill most of the height of the main building. These range in size from 500 to 7,000 bushels capacity, so as to suit every requirement. Much of the grain received is simply graded and an equivalent weight of grain of the same grade is delivered when called for. Other grain is received to be received with its "identity preserved." In this case, the specific grain and no other must be delivered on call. The great variety in size of bins adapts the elevator to this work.

The garners, weighing bins, and storage bins have sloping bottoms, so that no grain lodges in them. An inclination of six inches in a foot is sufficient to insure this.

Grain is weighed once when received and once when delivered. Each weighing operation involves the elevation of the grain from the lower floor, where the bins deliver it clear to the top of the building, for delivery through the revolver and fixed chute to the proper scale.



LOADING A VESSEL WITH GRAIN.

Transfer elevators are employed to effect the transfer of grain from one bin to another. These elevate it, so that it can descend through inclined chutes in the desired direction. If the chute does not carry it far enough, one or more additional elevators and chutes are called into requisition.

It is evident that a vast amount of complication is involved in the perpetual filling and emptying of bins, due to the receiving, delivery, and transfer of grain among the number of bins and pockets of the great building. The receiver's office is shown in Fig. 1. In this room the record is kept. It contains a large blackboard divided into squares. Each square denotes a bin and is numbered in accordance with the bin number. The numbers are the same as those painted on the mouths of the fixed chutes as shown in Fig. 2 of the cuts. Upon each square the accountant marks with colored chalk the contents of the particular bin, the bushels of grain, its kind, grade, etc. For different classes of grain different colored chalk is used.

Again the bins are divided into storage, cleaning and delivery bins. It is important to see at a glance how these inter-connect by the elevators and chutes. Accordingly above the blackboard proper is a plan of the system of elevators and chutes, so that the proper course to be followed by grain under any given circumstances is at once seen.

One function of the elevator is the cleaning of grain. Some of the bins, termed, as has been just stated, cleaning bins, are equipped with winnowing fans for blowing out dust and chaff and with screens through which the grain has to pass. The latter remove the coarser particles. The winnowed and sifted grain then falls into the bin.

The bins all terminate some distance above the ground level. A train of cars has ample head room below them. From the level of the bottoms of the bins to the weighing floor the entire area is devoted to the honeycomb of bins, except the few small trunks through which the elevator belts travel or through which grain descends into bins situated under other ones. A space at one end is also free for the great driving belt to travel in.

The elevator belts descend into hoppers below the ground surface into which grain to be elevated is delivered. At intervals along the platforms forming the bottom floor are trap doors giving access to these hoppers. Grain never remains there, but it is at once elevated.

One of the cuts, Fig. 5, show how it is delivered from cars into these elevator hoppers or chambers. What is known as a steam shovel is employed. This is a scraper about three feet square to which a rope is attached. The rope is attached to steam apparatus by which it is taken in at the proper time, as if on a windlass. The operative draws the shovel back into the car of grain, and holds it nearly vertical and pressed down into the grain. The rope draws along the shovel with the grain in front of it and a number of bushels are delivered at each stroke. In this way a couple of men can very quickly empty a car. The movements of the shovels succeed one another with sufficient rapidity to keep the men in active movement.

One of the features of this elevator is the use of the electric light. It is equipped with some so arranged as to light the interior of cars, so that night work can be carried on. In the recent heavy grain deliveries it was found necessary to work day and night.

The portion of such elevators containing the bins is built without framing. Planks are laid flatwise upon each other and spiked through to the layer below. In this way the outer walls and the bin divisions are built up, giving immense strength and power to resist lateral thrust. A usual timber for the sides is 2×8 inch spruce, giving eight inch walls, and for the bins 2×6 inch is often employed. The Armour elevator contains over 8,000,000 feet of wood, and about 4,000 kegs of nails were used in its construction. The main building is bricked in outside of the timber walls, and the roofs and cupola walls are covered with tin. It was erected between June, 1887, and March, 1888, being put in operation on the last named date. It cost about $600,000.

The elevator described represents one of many similar structures situated in the principal cities of the United States and designed to handle the enormous grain crops of the Western States and Territories. This group of elevators, Fig. 4, represents but a fraction of Chicago's elevator capacity. To give some idea of the extent of the business in our cities, the following statement of number of elevators and their capacity for some leading cities will be of interest:

Name of City.	Number of stationary elevators.	Capacity in bushels.	Name of City.	Number of stationary elevators.	Capacity in bushels.
New York	27	27,275,000	St. Louis	12	11,960,000
Chicago	26	28,675,000	Milwaukee	9	5,430,000
Duluth	14	19,200,000	Detroit	4	2,900,000
Minneapolis	16	13,290,000	Peoria	5	2,150,000

The elevator charges of course are subject to change, but in general are based on the following services rendered: 1. Receiving, which includes a fixed period of storage, which may be twenty days. 2. Extra storage based on a minimum period, such as fifteen days. 3. Cleaning grain as described for the cleaning bins. 4. Transferring grain, as from cars to barge or vessel, or *vice versa*. The favorite position of elevators is on water, to enable them to serve either cars or vessels as required.

The great crops are corn, wheat and oats. In the year 1890 the corn crop was 1,489,970,000 bushels, at an average of 20·7 bushels per acre; the wheat crop 399,262,000 bushels, at an average of 11·1 bushels per acre; and oats 523,621,000, at an average of 19·8 bushels per

(*Continued on page 261.*)

To Remove Iron Rust.

The engineer who is so unfortunate as to have a portion of his engine become rusted, or the more fortunate man who takes charge of an engine which has been neglected and is covered with rust, finds before him a tedious job in cleaning and getting the metal to again present a polished surface. Rust, chemically considered, is an oxide of iron when it appears on iron or steel, but the combination of oxygen and any other metal will form a rust, although in such cases it is usually given another name. The combination of oxygen with iron can only take place to an appreciable extent in the presence of moisture or hydrogen, and if extensive leaves little depressions in the metal when the rust is removed. This occurs from the fact that when the oxygen combines with the iron, that portion of the iron forming the combination is loosened or separated from the mass. There are two ways in which rust may be removed from iron or steel. The first and most common practice is by the use of some abrasive material, and the process is usually termed scouring. Another method is by chemical action, by the application of some chemical applied in solution, which has a high affinity for oxygen and which withdraws the oxygen, leaving the iron particles free.

One of the best compounds for such purposes is given by the *Chronique Industrielle* as follows: Potassium cyanide 15 grammes, soft soap 15 grammes, whiting 30 grammes, and sufficient water to form the ingredients into a paste. This is to be applied as a scouring material and well rubbed over the rusted surface, after which it is to be thoroughly wiped off and a coating of oil applied to stop further action. The active material in this composition is the potassium cyanide, which has the strongest deoxidizing property of any substance with which we are acquainted; and further, it is one of the most poisonous substances known, the base being potassium, which is combined with cyanic acid, and cyanic acid is so poisonous that it is extremely dangerous to use in any manner unless partially neutralized by combination with some other substance, as in the present case.

Cyanic acid is of itself a gas, and in this condition it is extremely destructive to life, the inhalation of even a small quantity being sufficient to cause instantaneous death. When in solution in water the liquid is called hydrocyanic acid, a single drop of it, if taken internally or entering the system in any manner, being sufficient to cause death within the short space of two seconds of time.

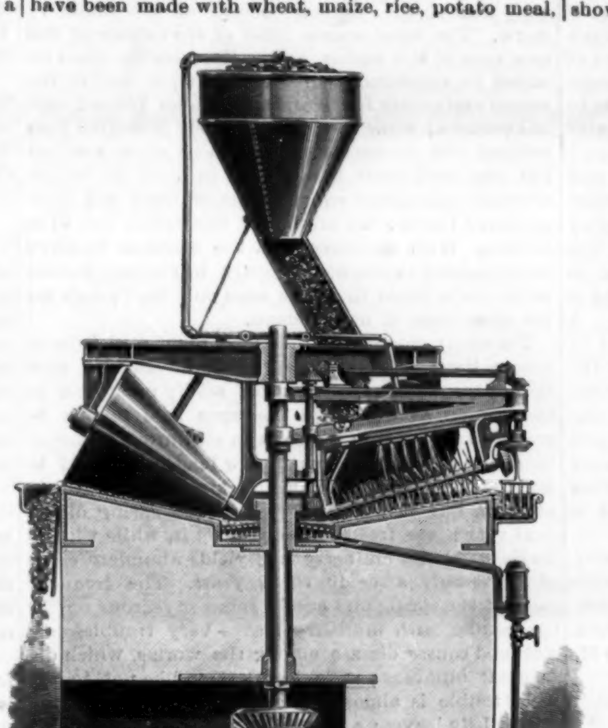
No particular danger is to be apprehended from the use of the composition given for removing rust, as the addition of soft soap, which is of equal weight with the cyanide of potassium, goes far to counteract the acridity of the cyanide. Then the further addition of whiting in double the amount of cyanide reduces the strength of the compound so much that it is relieved of the greater part of its dangerous properties.

If any one attempts to make use of this compound for scouring purposes, we would suggest that he do so only when the hands are free from abrasions of any kind, as if it should come in contact with any portion of the flesh where the skin is removed a very bad sore would probably be the result.—*Stationary Engineer.*

Corn Beer.

The *Handels Museum* of July 2 states that a new brewery product, namely, beer made from maize, is being manufactured and consumed in increasing quantities in France. The cost of production is said to be much below that of beer made from barley, notwithstanding that the beer itself is in no way inferior to the latter.

The new beverage is not the result of any improved process, but is made by malting maize, of which it is a pure product, and not (as is done in some districts) the result of mixing maize meal with the worts of barley malt. Owing to the high price of malt, brewers have for a long time been driven to use unmalted cereals for brewing purposes. Experiments have been made with wheat, maize, rice, potato meal, maize sirup, etc.; in such cases there was an insufficient development of the saccharin principle, and, owing to a lack of soluble nitrogenous bodies, fermentation did not proceed satisfactorily. Hence the beer became spoiled by a second fermentation, and further there was a lack of albuminous matter and phosphates, which constitute the nutritive properties of beer. These defects are all said to be remedied by using maize malt.

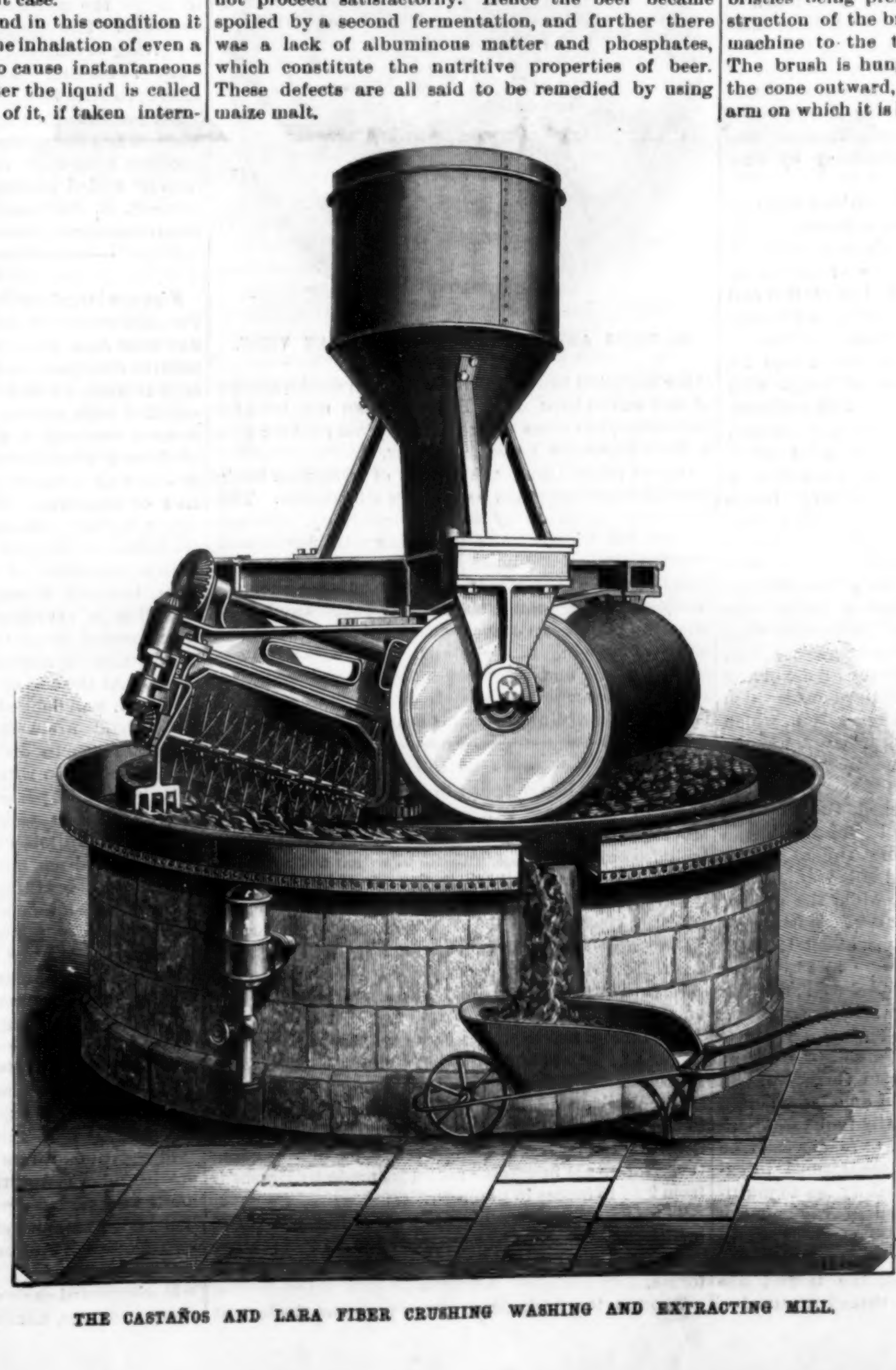


WASHING AND EXTRACTING MILL—SECTIONAL VIEW.

AN IMPROVED FIBER TREATING MILL.

Messrs. Gabriel Castaños and Guadalupe Lopez de Lara, two Mexican engineers, have invented and introduced the fiber crushing, washing, and extracting mill shown in the accompanying illustrations, which has already been successfully employed in Mexico in the treatment of the maguey plant, whose fiber is an excellent substitute for hemp, and from the fermented juice of which is made a sort of brandy called mezcal. For the proper treatment of this plant, the dextrine juices of which are converted into glucose during the preliminary operations, it is necessary to thoroughly disintegrate and separate the fiber, at the same time washing it efficiently, to extract all the juice containing glucose, and the methods of doing this work heretofore employed by Mexican manufacturers have been most rudimentary and imperfect. The mill we illustrate is said to satisfy all the conditions of a good machine, giving sure and satisfactory results, and it is claimed that it may be advantageously employed for the extraction of the juice of all kinds of fruits, for oil and the separation of the fiber, in the manufacture of sugar from beets, and in all industries connected with the treatment of pulpy or fibrous materials.

The annular bed plate of the mill has a central depressed basin, with a perforated cover or strainer. The juice, running into this basin as the mill is operated, is conducted by a pipe to a receiver at one side, and there is a central sleeve fixed in the basin affording a journal box for a vertical shaft connected by bevel gears with a horizontal driving shaft. The vertical shaft carries at its upper end a three-armed spider-like frame, each arm of which has depending hangers, the hanger at the inner end of each arm being connected with a collar fitting on the vertical shaft, and the hangers having boxes which receive the journals of conical rollers, rolling upon and rotating around the axis of the bed plate. Fixed to the vertical shaft immediately below the spider is an arm with depending brackets carrying a cone-shaped brush, the ends of the bristles just reaching the bed plate and the bristles being preferably of wire, although the construction of the brush may be modified to adapt the machine to the treatment of different substances. The brush is hung in the machine with the base of the cone outward, and its axis is at an angle to the arm on which it is hung, so that as it revolves it forces the material gradually toward the outer edge of the bed plate. The angle of inclination of the brush can, however, be easily changed, to move the fresh material more or less rapidly to the outside. With the brush at its greatest inclination twenty-five revolutions are required to remove the material from the bed plate, and during this operation it will be pressed upon an equal number of times by each of the revolving conical rollers, the squeezing pressure being thus seventy-five times repeated on all portions of the material. A longer period of treatment may be obtained by changing the inclination of the brush, which may be so arranged as to move the material only in a circle, where it will be kept continuously under the rollers as long as may be desired, and will not be moved toward the outside at all until a change is made for that purpose. The revolution of the brush is effected by means of a vertical shaft having a pinion on its lower end meshing with teeth on the upper end of the sleeve in the central basin, a beveled pinion on the upper end of this shaft meshing with another pinion on a horizontal shaft on the brush-supporting arm, at the outer end of which is a short vertical shaft with bevel gear connecting with the outer end of the brush shaft, so that as the brush-supporting arm swings around, the brush shaft will be revolved. The material, cut in pieces of the desired size, is delivered from the hopper to the central portion of the bed plate, and water is supplied as may be necessary,



THE CASTAÑOS AND LARA FIBER CRUSHING WASHING AND EXTRACTING MILL.

either cold or hot, according to the character of the fiber. Maguey juice is very heavy, having about the consistency of sirup, and it is necessary to supply water to thin the juice so that it will flow readily, the juice also being more easily extracted when the material is thoroughly wet. Simple appliances or accessories can be readily added to keep the temperature of the machine, or its bed plate and rollers, comparatively high, should this be deemed advantageous in the treatment of some kinds of material. The water supply pipe is connected with a circular pipe mounted on the spider, as fully shown in one of the views, and extending laterally from this pipe are bent branches having at their outer ends suitable jets which spray the water upon the bed plate near the rollers. The supply pipe is bent inwardly above the hopper, so that its axis will align with the central shaft, and it may revolve with the hopper on which it rests. A trough extends around the outer edge of the bed, in which travels a fork supported from a bracket on the outer end of the brush-supporting arm, and at one point in the trough is a suitable opening for the discharge of residuum, the fork pushing along the material forced outward by the brush, after the juices have been thoroughly extracted, and a barrow or other suitable receptacle being placed under the opening to receive it.

These mills are being manufactured by Messrs. Robert Deeley & Co., of New York City, and further particulars may be obtained by addressing Messrs. Fred'k Probst & Co., No. 51 Broad Street, New York City, or Mr. Gabriel Castaños, Apartado de Correo 43, Guadalajara, Jalesco, Mexico.

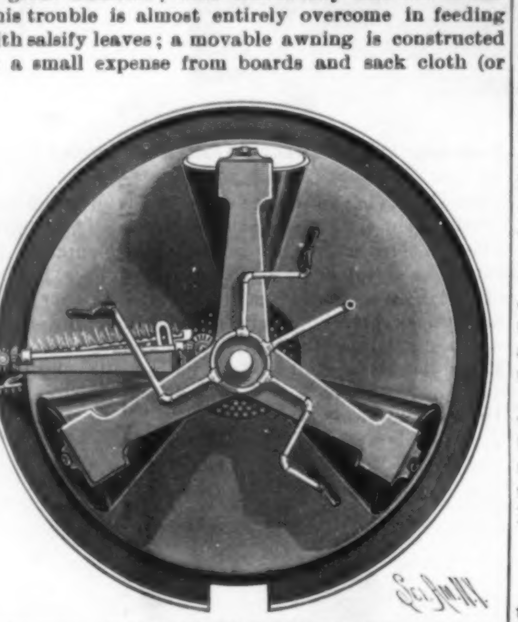
Experiments in Sericulture in Germany.

One of the reasons why the propagation of the silk worm (Bombyx mori) north of the Alps has gradually decreased to almost nothing is the want of suitable food for it, as the white mulberry tree, whose leaves furnish the best nourishment for the worm, does not well grow in the climate of Central Europe. Repeated experiments have been made, therefore, in Germany to feed the silk worm with other than mulberry leaves, but most of them proved failures. It seems, however, that renewed experiments, which were undertaken at Munich, have been fairly successful, and as the climate of the Middle and Eastern States is about the same as that of Central and South Germany, it may be of interest to American sericulturists to communicate the report of the *Augsburg Allgemeine Zeitung* of a lecture delivered on the subject at the centennial celebration of the Munich Veterinary Academy by Professor C. O. Harz, as follows:

By preliminary experiments with various races of the mulberry silk worm it had been ascertained as early as 1885 that the worm may be compelled by hunger to eat the blossoms and leaves of several indigenous plants, especially of those of dandelion and salsify (Scorzonera hispanica) and that it can for some time subsist upon them, especially if mixed with mulberry leaves, and that several worms which had for four weeks kept alive on this food, although with very little growth, when afterward fed with mulberry leaves alone, produced normal cocoons nevertheless. Another experiment was made in 1886 with the yellow Milan worms and leaves of salsify for food, which, however, had again to be replaced by mulberry leaves toward the close of the feeding period, with the result that out of 1260 worms, 14 cocooned. The cocoons of these worms were lighter, the threads spun by them thinner and weaker, than those of the original Milanese, but from most of them well formed moths were obtained, which produced 389 eggs. In the following year (1887) 357 little worms issued from these 389 eggs, which were now fed with salsify leaves alone, giving 27 cocoons, from which 26 moths were developed, which laid 1646 eggs. The thread of this generation, which had been exclusively fed with salsify leaves, was decidedly stronger than that of the preceding one, which had still partly been fed with mulberry leaves. In 1888 nearly all the 1646 eggs hatched, the first 1140 were again raised on scorzonera leaves alone, and yielded 338 normal cocoons, whose thread was in strength nearly equal to the original Milanese silk. It broke by a weight of 5 grammes, while the normal thread resists a weight up to 6 grammes. Moths were obtained from nearly all the cocoons, and laid 18,000 eggs. About 9,000 of these eggs were in 1889 again hatched in the incubator at 25° C. and the 3,700 worms issued in the first three days were taken to be raised. Although the cold and damp weather and scarcity of food acted unfavorably, Dr. Harz obtained after 33 days 735 cocoons, whose easily reeled thread was in length and strength equal to that of an average crop.

The fact was achieved, therefore, by four years' culture from generation to generation, to render the true silk worm, Bombyx mori, so far accustomed to exclusively subsist on the leaves of salsify as to multiply and yield a cocoon fiber which is nearly equal to that obtained by mulberry food. The cocoons produced in the fifth year, 1889, on the whole left little to wish as regards size and weight; the largest one weighed 1·39 grammes, the silk thread attained a length of nearly 800 meters, its diameter is exactly that of the original Milanese silk thread, it has the same tensile strength as the latter, breaking only at a load of 5—6 grammes. The gloss of the fiber is exactly that of the normal thread of the mulberry worm. The latest season (1890) of the culture of this new race of silk worms, as Dr. Harz states, again resulted in satisfactory progress; 84·2 per cent of the worms exclusively fed scorzonera leaves yielded normal cocoons; while the heaviest of the preceding year weighed 1·39 grammes, those of this year weighed 1·83 grammes; their thread was in gloss or tensile strength completely equal to the ordinary silk from mulberry leaves; the lifetime of the worms was 30 to 47 days. With mulberry food the worm of Bombyx mori required in the past century in Central Europe 40—50 days, while they now used only 29—33 days for the absorption of nourishment.

The cultivation of the new food plant salsify (Scorzonera hispanica) presents various advantages over that of the mulberry tree. The salsify plant can in the garden as well as in the open field rapidly be grown to any extent; it grows in all Europe in mountainous regions as well as in low lands; if sowed in May, a fair crop of leaves is already obtained in autumn, but an abundant yield in the spring of the next year; late frosts scarcely affect it, while with us (in Bavaria) the mulberry tree yields abundant crops of leaves only after 10 to 20 years. The frequent rains of the spring and earlier summer seasons render the feeding with mulberry leaves very troublesome; wet food causes disease among the worms, which die in great numbers; stale leaves they like not to eat. This trouble is almost entirely overcome in feeding with salsify leaves; a movable awning is constructed at a small expense from boards and sack cloth (or



WASHING AND EXTRACTING MILL—PLAN VIEW.

other material) beneath which the required quantity of food can be kept dry. Besides, when not used for sericulture, the roots of scorzonera yield food for man and the leaves for domestic animals.

On the other hand, the leaves of evergreen buckthorn are recommended as food for silk worms. This discovery was made by an American lady, who employed her leisure hours in raising silk worms and, when the uncommonly mild weather of the winter before last caused the worms to appear before the mulberry and Osage orange tree had produced any leaves, tried the buckthorn leaves with good success. When afterward one-half of the worms were fed with Osage orange leaves, and the other continued on buckthorn, the surprising result was that the latter yielded larger cocoons of finer threads than the former.

Some Telescopes in the United States.

Dr. Wm. H. Knight gives in a recent number of the *Sidereal Messenger* a list of over one hundred telescopes, with names of owners, makers, etc. The list includes only those instruments of which the aperture is four inches or upward.

The twelve largest refracting telescopes are those of the Lick Observatory with an aperture of 36 inches, Yale University 28, U. S. Naval 26, Leander McCormick 26, Princeton 23, Denver 20, Smithsonian 20, Dearborn 18·5, Carleton College 16·2, Warner 16, Washburn 15·5, and Harvard 15.

The largest reflecting telescopes are those of Harvard College, 28 inches, and Rev. Dr. John Peate, 22 Dr. Peate, who is an amateur maker, is now finishing up a 30½ inch silver-on-glass mirror, which will be presented to the Allegheny College at Meadville. When mounted it will be the largest reflecting telescope in this country. There are numerous reflectors made by Brashear from 9 to 12 inches in diameter.

The Clarks are now grinding an object glass of 40 inches for a telescope to be mounted in an observatory yet to be built upon Mount Wilson in Southern California.

Though the Lick Observatory possesses the largest telescope at present, Harvard College has the best equipped observatory for general astronomical work in America, and one of the best in the world.

In foreign countries the largest refractors are those at Pulkowa, near St. Petersburg, 30 inches, Nice 29·75, Vienna 26·75, Gateshead, near London, 25, and Paris 23 6.

The largest reflectors are those of Lord Rosse, in Ireland, 72 inches, Melbourne 48, Paris 47, Mr. Common's, in England, 37·5, another of Lord Rosse 36, Toulouse 32·4, Marseilles 31·5, Greenwich 28, and Cambridge 24.

Castor Oil and Malt Extract.

Castor oil has for many years been regarded as one of the most generally useful aperients, but its employment has been considerably limited on account of its nauseous flavor. As many experiments have been made with a view of obviating this difficulty, the idea suggested itself of employing extract of malt as a vehicle, since the extract has been found so useful in masking the taste of cod liver oil and other medicines of a nauseating character which are objected to by so many people.

The specimens presented are composed of nearly equal quantities of oil and extract of malt. They have been submitted to many therapeutists, and a general opinion has been expressed that the nauseous flavor of the oil is very little or not at all perceptible, and that no disagreeable taste is left in the mouth after the administration.

One advantage in the employment of extract of malt for disguising the flavor of castor oil is that the extract is itself a mild aperient in large doses and may be found a valuable aid in connection with the castor oil. The *rationale* is readily seen. The gum in the Mistura olei ricini tends to cause early decomposition of the preparation, whereas the pseudo-solution of castor oil in malt extract appears to keep perfectly for an indefinite period. It will be observed that the mixture is light and clear. I am not yet able to say whether the oil is actually dissolved in the extract; I hesitate to call it a solution, but the chief evidence in favor is that, as I show it, it is translucent, and upon adding to water the mixture becomes turbid and forms an emulsion. The combination is I believe well adapted for giving to children and fastidious persons, and thus assists in making the oil available to patients hitherto unable to take it.

For preparing the mixture the mortar should be first warmed and the extract of malt triturated in it until it becomes somewhat liquefied. The castor oil should then be added gradually during continuous trituration.—S. M. Burroughs in paper read before British Pharmaceutical Conference: after *Chem. and Drug.*

Fig Wine.

Figs are largely employed, especially in Algeria, for the production of fictitious wine. For this purpose figs from Asia Minor are preferred on account of their relative cheapness and richness in sugar. When the fruit is treated with a suitable quantity of tepid water, acidified with tartaric acid, fermentation rapidly commences, resulting in the production of a vinous liquid of about 8° alcoholic strength, and so inexpensive that it defies all competition of genuine grape wine, Algerian or otherwise. Fig wine cannot be distinguished either by taste or the ordinary methods of analysis from genuine grape wine, especially when it is mixed with a proportion of the latter. The detection of fig wine, however, is rendered comparatively easy by the fact that it contains mannitol. In order to separate the mannitol, 100 c. c. of fig wine are evaporated to a sirup which is allowed to stand in a cool place for 24 hours. At the end of this time the residue will have solidified, well defined groups of crystals being formed. The crystals are washed with cold alcohol of 85 per cent strength in order to remove impurities. The residue is mixed with animal charcoal and extracted with boiling 85 per cent alcohol and filtered. The alcoholic solution yields on evaporation a crystalline mass of mannitol which may be recognized by its physical and chemical properties. Certain white wines from the Gironde district, as well as raisin and some other wines, contain mannitol, but only to the extent of a few decigrammes per liter; while fig wine contains from 6 to 8 grammes per liter. By a determination of the mannitol it is possible to detect an adulteration of normal Algerian wine with one-half or even one-fourth of fig wine.—*P. Carles.*

Steam Wagons.

The owners of the San Bernardino County, Cal., iron mines, near Haslett, propose to haul ore from the mines to the railroad with steam traction engines.

The steamers were built by J. B. Osborne to haul ore 100 miles across the Mojave desert. Each engine hauls two trail wagons. The engines have 20 H. P. boilers. Auxiliary engines are placed in the trail wagons, which are connected with the forward boilers by steam pipes.

It is expected each set of wagons will make a trip every two days, hauling twenty tons of ore.

TRANSPORTATION OF GRAIN IN THE UNITED STATES.

(*Continued from page 258.*)

acre. Rye with 27,140,000 bushels and barley with 58,800,000 complete the great grain crops giving a grand total of 2,498,793,000 bushels from 139,589,286 acres.

Much of this is exported either as grain or as flour. We will take 1890 as before. Of wheat as grain, 49,271,580 bushels were exported, representing about one-eighth of the crop. This is supplemented by an exportation in the same year of 11,319,450 barrels of wheat flour. Of corn 86,817,220 bushels and of oats 12,207,359 bushels were exported. There were smaller exports of rye and barley and of rye flour, while 14,725,268 lb. of bread exported represent a quantity of flour of different grades.

The total exports reduced to a bushel basis covering flour and meal and all cereals was 203,220,344 bushels, which is less than one tenth of the crop.

Thus it is evident that America, while fond of considering herself the world's granary, is far busier feeding herself than in feeding others.

These exports are of domestic produce, but there was an export also of foreign grain, aggregating 654,225 bushels. While thus pouring out her surplus products, America also imported 11,795,548 bushels of grain, including 9,375,407 bushels of barley alone.

The business done in exports at the different seaports is interesting. Reducing flour and meal of all kinds to the bushel standard, we have for the following ports in 1890:

Name of City.	Bushels of grain of all kinds exported.	Name of City.	Bushels of grain of all kinds exported.
New York	64,324,084	Montreal	13,168,963
Philadelphia	21,346,268	New Orleans	13,951,463
Boston	12,165,965	Baltimore	36,207,554

What is ultimately done with the grain received at any given city is not easily determined, except in the case of seaboard cities. In the case of New York, 122,013,670 bushels, on the basis of the last table, were received, indicating that a little over one-half the receipts was exported to foreign countries from this center.

At seven Atlantic seaboard ports, 280,149,420 bushels were received, an excess of about 77,000,000 bushels over the total exports.

The year 1890 by no means represents a good crop. The comparison with other years is given here.

Year.	Crop of all grains in bushels.	Acreage.	Year.	Crop of all grains in bushels.	Acreage.
1880	2,703,575,966	120,103,484	1886	2,830,710,000	140,941,741
1881	2,056,543,370	122,559,255	1887	2,649,613,000	140,910,809
1882	2,699,375,143	125,721,423	1888	3,197,692,000	145,368,370
1883	2,621,650,135	129,776,207	1889	3,449,067,000	149,265,826
1884	2,981,764,000	135,413,363	1890	2,498,793,000	139,589,286
1885	3,002,513,000	134,961,086			

What the production and acreage of the present year will be cannot be yet definitely stated. It is certain that it will be very large. One very curious thing to notice in the last table is the almost unbroken increase of acreage, with attendant fluctuations in crops. Thus 1887 shows an increase in acreage of about 11,000,000 acres over 1883, but with a very slight increase in production.

The fluctuation in yield per acre is shown in the following table for the same years. This fluctuation is at the root of the above difference in proportion of area cultivated to crop produced.

	Bushels per Acre of						Bushels per Acre of				
Year.	Wheat.	Corn.	Oats.	Rye.	Barley.	Year.	Wheat.	Corn.	Oats.	Rye.	Barley.
1880	13·1	27·6	25·8	13·9	24·5	1886	12·4	22·0	26·4	11·5	22·4
1881	10·2	18·6	24·7	11·6	20·9	1887	12·1	20·1	25·4	10·1	19·6
1882	13·6	24·6	26·4	13·4	21·5	1888	11·1	26·2	25·9	12·0	21·3
1883	11·6	22·7	28·1	12·1	21·1	1889	12·9	27·0	27·4	11·9	22·2
1884	13·0	25·8	27·4	12·2	23·5	1890	11·1	20·7	19·8	11·8	21·0
1885	10·4	26·5	27·6	10·2	21·4						

As regards transportation by different methods, New York offers as great a variety as any city. It receives grain, flour, and meal by canal, by vessels coastwise, and by rail. For 1890 the following were the receipts:

By Canal. Bushels.	By Vessels, Coastwise. Bushels.	By Rail. Bushels.
30,185,400	1,609,551	90,218,719

This shows that the slowly moving canal boat is a very large factor in the transport question even at the present day. In grain alone the canal figures to still greater advantage as follows:

By Canal. Bushels.	By Vessels, Coastwise. Bushels.	By Rail Bushels.
30,185,400	846,440	63,938,068

For the fiscal year July 1, 1890, to June 30, 1891, the aggregate value of cereals exported was $152,425,224, at an average rate of 66·2 cents per bushel. Wheat and flour represented $102,312,074 of this amount.

England is our best customer. The following figures show the distribution of exports from the United States.

	Wheat. Bushels.	Corn. Bushels.		Wheat. Bushels.	Corn. Bushels.
Great Britain	38,940,523	54,601,084	Belgium	3,741,903	4,798,323
Canada	2,270,709	9,365,811	Brazil	1,768,234	...
Germany	8,786	11,419,063	Denmark	......	5,788,733
France	3,846,505	8,481,129	Portugal	2,812,483	20,000

Correspondence.

Cheap Shoes Wanted.

To the Editor of the Scientific American:

Will not some philanthropic genius invent a cheap summer shoe, fit for human beings to wear and leaving the foot in its natural position, with freedom for natural expansion in all directions? Hints might be gathered both from the sandals worn at the birth of the Christian era and the moccasins worn by the American Indians, neither of which would cramp the toes or elevate the heel, and one of which would give free ventilation, which the modern shoe prevents.

R. S.

Casting Bullets for Ready Identification.

To the Editor of the Scientific American:

I have invented an improvement in bullets, the idea being to insert a plug of harder metal to designate and identify the bullet wherever it may be found. Thus if a policeman was to discharge his revolver at a burglar and the night being too dark for recognition, were the burglar to escape with one of the marked bullets in his body, it would serve as an identification. Much speculation is now spent as to size of bullets, etc., when taken from wounded criminals. The cartridge men think it would hardly pay to make special bullets, although the novelty is admitted. I think the idea is too good to lie dormant, and am willing to contribute it to the public through either of your papers, of which I am a subscriber.

The idea would be for the police in each city to have a distinguishing mark, such as the following: +, ■, I, ●, △, and others. GEO. H. IRELAND.

Springfield, Mass., Sept. 18, 1891.

Interesting Discovery at Wolfville, N. S.

To the Editor of the Scientific American:

At the head of Minas Basin, a few feet above tide water, some very interesting remains have lately been found on the premises of Mr. W. C. Archibald, of the town. The place in question has been a small hill of sand as far back as any of our residents can remember; but within the last twelve years Mr. Archibald has removed about six feet of soil, and in doing so came to traces of building. Recently he has had the place thoroughly dug over, and the following remains have come to light.

1st. A floor of hewn boards, probably hemlock, charred on upper side.

2d. Rough bricks or irregular pieces of clay reddened and hardened by fire.

3d. Charcoal, or charred wood, and sticks which may have been wattles.

4th. Iron implements, as wrought nails, file, knife, and portions of vessels.

5th. Copper coin and gun guard.

6th. Small pieces of crockery, a bowl of clay pipe two inches high, and several stems.

There was evidently a small house here at some remote period, which was burned down and the site of which has since been covered by six feet of sand. The land surrounding this is alluvial, but it is not easy to account for this evidence, or to say whether the remains belong to the Acadian or Norse period.

A. E. COLDWELL.

Acadia College, Wolfville, N. S., Oct. 1, 1891.

English and American High Speed Performances.

Concerning the rapid railway trips lately made in this country, our London contemporary *Engineering* remarks:

There has been a train run in America which has eclipsed the best examples ever yet seen in any part of the world. We pride ourselves on having the finest express service in existence, and no doubt we have, if it be considered as a whole, but our best performances are now equaled in America, and our very finest run, which only a few years ago excited the greatest enthusiasm, has been surpassed. It will be remembered during the race to Edinburgh that on August 13, 1888, the West Coast train ran from London to Edinburgh (400¼ miles) in 7 hours 38 minutes, and on the following day the East Coast train covered its distance (392¼ miles) in 7 hours 32 minutes. Again, on the 31st of the month the East Coast did the distance in 7 hours 26¾ minutes. The feat thus performed was 392¼ miles in 416¾ minutes of running time, subtracting the 26¼ minutes for lunch at York, 2 minutes at Selby, and 1¾ minutes at Ferry Hill. The speed, excluding stoppages, was 56·5 miles an hour all the way. Including all the stoppages, except the 26¼ minutes for luncheon, it was 56 miles an hour. This was certainly the best run ever made up to that date, but it was not an example of a regular service. The race only lasted about a fortnight, and ever since 8 hours has been the standard time for the journey on both routes, which gives an inclusive speed of 50 miles and a running average of 53½ miles on the longer route. Omitting the luncheon time, the average speed, including all other stops, is 52 miles an hour, or 400¼ miles in 460 minutes.

Now let us see what is being done in America. The Royal Blue Limited between Jersey City and Washington makes the run daily at an average speed of 52·8 miles an hour. This is just a trifle better than our West Coast Scotch expresses.

All these good runs have been put into the shade by one on the 14th of September, from New York to East Buffalo, 436½ miles in 439¾ minutes. When the news of this came by telegram it was received with incredulity, as the invention of a newspaper reporter, but with the full details before us it is impossible to deny credence to it. The run has certainly been made, and would have fulfilled the plan of its author, Mr. H. Walter Webb, third vice-president of the New York Central and Hudson River Railroad Company, of covering the entire distance at a mile a minute, had there not been 7½ minutes delay for a hot bearing. The following table gives the particulars of the runs:

Miles.	—		Time.	Speed.	
				Miles.	
	New York.		7:30 a.m.	61¼	59·52 miles an hour.
143	Albany	arr.	9:50 a.m.		
		dep.	9:53¼ a.m.	61	
291¼	Syracuse	arr.	12:19½ p.m.		
		dep.	12:28 p.m.	58¼	
463¼	E. Buffalo.		2:50		

From New York to Albany the line follows the windings of the Hudson River, which are very sharp, entailing curves of short radius. The track is practically level, except that a summit of 100 feet is surmounted at one place. The distance is 143 miles, and was covered in 140 minutes, at the rate of about 61¼ miles an hour. Three minutes and a quarter were consumed in changing locomotives, and the next stretch to Syracuse of 148 miles was done in 146 minutes, or at the rate of 61 miles an hour over an undulating country. In 2½ minutes another locomotive was coupled on and the run of 145 miles to East Buffalo was commenced. This was over a level line, and was done in 148 minutes, in which is included a stop of 7½ minutes for a hot bearing. Had it not been for this delay, the splendid run of 145 miles in 140½ minutes would have been made at the rate of 62 miles an hour. As it was, the entire journey only exceeded by 3½ minutes the determined rate of 60 miles an hour for 7 hours 16 minutes, including stoppages.

The train consisted of a locomotive weighing 60 tons and a tender weighing 40 tons, a drawing room car 40 tons, a buffet car 33 tons, and a private car 38 tons, or about 210 tons in all, by no means a light train. The engines had cylinders 19 inches in diameter by 24 inches stroke. The first had 6 feet 6 inches coupled driving wheels, and the other 5 feet 9 inches wheels. The total heating surface of the first engine reached the high total of 1821·5 square feet, and the grate area was 273 square feet. All the tenders were fitted to take up water during transit, and were able to carry 6¾ tons of coal.

It is easy to guess the cause of this feat being attempted. There will be great rivalry among the railways running to Chicago during the exhibition year, and they are already beginning to show the public what they can do. On the line on which the run was made there are four tracks over the first section and six over the remaining sections to Buffalo, so that it offers ample facilities in the way of a clear course for fast traffic. It has a well laid roadbed and easy gradients. The curves are very bad as far as Albany, but American rolling stock is built to follow a sinuous track, and winds its way with comparative ease. If there should be a notable increase of railway speed in America, we shall expect to see further improvements here, and our moderate distances still further decreased.

Floral California.

The Orcutt Seed and Plant Company, San Diego, California, have issued an interesting descriptive list of Californian trees and flowers. The writer thinks that there is perhaps no country in the world where the early spring flowers so change the face of the earth from a desolate waste to a beautiful garden as on the Pacific coast—hills, mesas, mountains and valleys, and the arid plains of the desert, alike quickly responding to the vivifying rain. "California," he says, "has probably already furnished to the horticulturist a greater variety of beautiful flowers and stately trees than any other State in the Union. Yet many others are awaiting the appreciation of man, or wasting their sweetness on the desert air."

Getting Rid of Fleas.

A correspondent of the Washington *Star*, who has been studying the subject of getting rid of fleas, gives this as the result of his investigations: If those who are troubled with this insect will place the common adhesive fly paper on the floors of the rooms infested, with a small piece of fresh meat in the center of each sheet, they will find that the fleas will jump toward the meat and adhere to the paper. I completely rid a badly infested house in two nights by this means.

The Lacquer Tree in Germany.

On his return from Japan, sixteen years ago, says *Nature*, Prof. Rein, the well known authority on Japanese art and industry, planted in the Botanical Garden at Frankfort some specimens of the lacquer tree (*Rhus vernicifera*), from which the Japanese obtain the juice employed in the production of their famous lacquer work. According to the *Times*, there are now at Frankfort thirty-four healthy specimens of the lacquer tree, 30 feet high and 2 feet in girth a yard from the ground; and the young trees, which have sprung from the original tree's seed, are in a flourishing condition. It seems to be proved, therefore, that the lacquer tree is capable of being cultivated in Europe, and it only remains to be seen whether the juice is affected by the changed conditions. The *Times* says that, to ascertain this, Professor Rein has tapped the Frankfort trees, and has sent some of the juice to Japan, where it will be used by Japanese artists in lacquer work, who will report on its fitness for lacquering. In the meantime, some of the most eminent German chemists are analyzing samples of the juice taken from the trees at Frankfort, and samples of the juice sent from Japan; and should their reports and the reports from Japan be favorable, it is probable that the tree will be largely planted in the public parks and other places in Germany. In course of time a skilled worker in lacquer will be brought over from Japan to teach a selected number of workmen the art of lacquering wood, and in this way it is hoped that a new art and craft may be introduced into Europe. Professor Rein has been conferring with the authorities at Kew as to the results of his experiment.

It would not be a bad idea for our Department of Agriculture to introduce the lacquer tree.

A CORRESPONDENT sends us the following account of a kaolin deposit recently discovered in Marion Co., Ala., which is said to be very heavy, covered in most places by a layer of earth not exceeding 4 or 6 feet in thickness. It is in two mounds or high hills, on either side of the large branch of Bear Creek, which by proper damming will afford ready means for transportation to the nearest railway station, 12 miles northeast, namely, Bear Creek. The specimens of the mineral are said to be remarkable for their purity, lack of sandy or gritty particles, and absence of any veins or stains of iron, which would deteriorate the value and usefulness of the clay. The deposit seems to be of great depth.

CORNELL UNIVERSITY—THE NEW CHEMICAL LABORATORY.

CORNELL UNIVERSITY—PRINCIPAL FLOOR PLANS OF THE NEW CHEMICAL LABORATORY.

THE NEW CHEMICAL LABORATORY OF CORNELL UNIVERSITY.

The growth of Cornell University and the superior facilities which it offers for the instruction of students are exemplified in the new chemical laboratory lately completed, of which we now present a few illustrations, plans, and particulars.

The building was designed by C. Francis Osborne, assistant professor of architecture at the university. It is in the form of an irregular parallelogram, 186 feet in length, 50 feet wide in the main portion and 70 feet in the wings. The edifice is constructed of red brick, with trimmings of Medina sandstone; the roof is of gray slate. Slow-burning construction was employed throughout. Across the main part of the building, dividing each floor into three nearly equal parts, run two flue walls, 3 feet in thickness, marked F F in the plans. These contain a great number of separate air flues leading from the hoods.

The *Qualitative Laboratory* contains 88 work tables, arranged in six double rows. Each table is provided with three drawers and three cupboards below, so that by suitable arrangement of working hours three students may occupy one desk, making it possible to accommodate, in all, 264 students in this laboratory. There is a circular porcelain sink between every two adjoining tables; the waste pipes from these descend vertically through the floor and discharge into troughs on the ceiling of the sub-basement below.

Hoods or fume closets, with sliding glass sashes, extend nearly the whole length of the flue wall on the east side of the room. Several of these hoods are devoted exclusively to the use of hydrogen sulphide, the gas being conveyed by pipes from the sub-basement, where it is made in large, self-regulating generators.

There is a weighing room provided with balances for the use of certain students, who, during part of the year, carry on quantitative work in the qualitative laboratory. Beyond these rooms is situated the chemical laboratory of the United States Agricultural Experiment Station, completely equipped for the various kinds of analyses here performed, especially the estimation of fat, and of nitrogen by the Kjeldahl method.

Oxygen and Hydrogen.—These gases are obtained by the electrolysis of water in twelve pairs of glass cells with electrodes of lead, placed in a trough of water. The current is brought into the building from the electric laboratory, where it is generated by a Siemens dynamo, driven by the water power of the falls in the gorge below the university. This

dynamo is one of those used at night to light the campus. The current employed for electrolysis is of 5 amperes at 75 volts, and is sufficient to yield about three cubic feet of hydrogen per hour. The tanks for storage of gas have a capacity of fifty cubic feet each. From these tanks pipes extend to all the laboratories and lecture rooms of the building, furnishing an abundant supply of pure gas for chemical work, combustion analysis, and the projection of lantern views on the screen for the illustration of lectures. A similar complete apparatus is in operation in the physical laboratory, and is connected by pipes with nearly all the lecture rooms of the university.

Organic and Applied Chemistry Laboratories.—These rooms have twenty-four slate-topped tables, provided with abundant hood space, pumps for vacuum distillation, and many other conveniences. Adjoining is a room for combustion analysis, a special laboratory for advanced work, a small photographic emulsion room, etc.

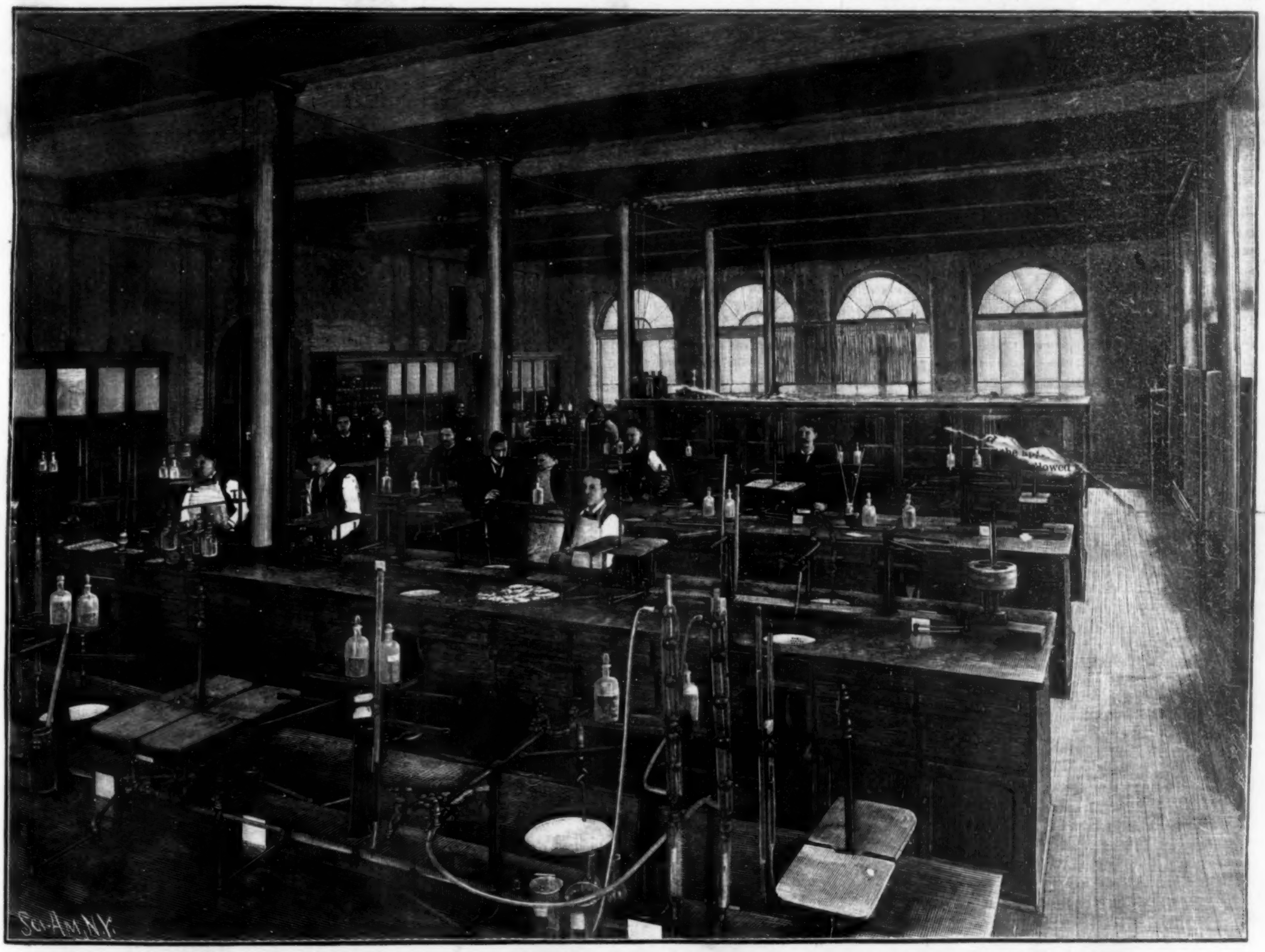
Quantitative Laboratory.—There are here 88 tables, some of which are so divided that two students can occupy the same place at different hours, while each tains ten balances. The reading room contains the chemical library of the university, numbering about 1,000 volumes, and including bound sets of all the important foreign chemical journals from their first issues. All these books are accessible to students during the working hours of the day.

East wing of the first floor is chiefly occupied by the laboratories of iron analysis, the sanitary laboratory, the optical room, and the smaller lecture room. The tables in the sanitary laboratory (and distilling room) are covered with lead. The optical room is equipped for spectroscopic and polariscopic work, the use of the microscope and micro-photography. The small lecture room contains eighty seats.

The Introductory Laboratory is 46 by 66 feet, and contains 88 working tables. Each table contains, however, three separate drawers with cupboards below, so that three students may work at different times at the same place, making the total capacity of the room 264. During the past year this number has been very closely approached. The room extends up into the gable of the roof, the heavy beams and trusses supporting which are wholly exposed. By this method of the whole of the second floor of the east wing. The ceiling of the room is formed by the roof of the building, the beams and trusses being exposed; the hall is therefore about forty feet in height in the center. It contains 352 seats, with arm rests. The plan of the room is such that no student is placed at a greater distance than forty feet from the lecture table, and the experiments performed are plainly visible to all. The acoustic properties of the hall are exceptionally good, probably owing to its shape, and the effect of the roof trusses in breaking up the sound waves.

Back of the lecture table are blackboards, hung with weights in such a manner that they can be easily raised and lowered, and behind these is a fume closet, or hood, which opens also into the adjoining preparation room. The building is heated throughout by steam. The cost of the building, furniture and fixtures was about eighty thousand dollars.

Instruction in the laboratory is given by Dr. G. C. Caldwell, Professor of Analytical and Agricultural Chemistry; Dr. Spencer P. Newbury, Acting Professor of General, Organic, and Applied Chemistry; Louis M. Dennis, Assistant Professor of Analytical Chemistry;



THE NEW CHEMICAL LABORATORY, CORNELL UNIVERSITY—VIEW IN THE QUALITATIVE LABORATORY.

has his own independent locker. The remaining tables are intended to be occupied by one student only; the room is thus capable of accommodating 106 students. The table in the middle of the room is provided with twelve inclosed cases, each containing a simple form of rheostat and the other arrangements necessary for carrying on two or three electrolytic determinations at once, with currents varying in strength, at the pleasure of the operator, from one-tenth up to ten c. c. of oxy-hydrogen gas per minute, as usually measured. Some of the other conveniences for quantitative work provided in this room are a steam drying closet of new construction, the temperature of which can be controlled at will up to 105° or above, a number of constant level water baths, kept constantly boiling, in a part of the hoods, heating places in the other hoods and at each student's table, and a suction pump for every student. Distilled water is prepared in a special condensing apparatus in the attic, and is stored in a large tank lined with block tin; from this tank the water is conveyed by block tin pipes to every working room. Air blast is abundantly provided in every room where it is needed from a large reservoir in the adjoining physical laboratory, kept full by an air pump constantly running.

The Balance Room of the quantitative laboratory con- construction a pleasing architectural effect and greatly increased air space are secured.

There is a "rostrum" or raised platform, with a completely equipped demonstration table and blackboard, from which the instructor gives announcements or explanations to the students, and which is so placed as to be plainly visible from all parts of the room. A slate slab for special experiments extends along the west side of the laboratory. In the corners are cases of drawers containing the various chemicals needed by the students.

The Museum, fifty feet in length, contains the collection of general and applied chemistry, consisting of several thousand specimens, displayed in glass cases, consisting chiefly of the materials and products of chemical industry. Many of the most interesting of these were collected at the Paris Exposition of 1889. The sulphuric acid and alkali industry, the manufacture of glass, porcelain, cement, illuminating gas, and gunpowder, the refining of petroleum, and the processes of photography, are illustrated with especial fullness. The organic collection contains specimens of all the typical compounds of carbon, a large part of which were prepared by students in the organic laboratory.

The Large Lecture Hall is 52 by 66 feet, and occupies and Dr. W. R. Orndorff, Assistant Professor of Organic Chemistry. The instructing force also includes six instructors and assistants in the various laboratories.

Paraffine in Diphtheria.

Mr. A. M. Sydney-Turner, Surgeon to the Gloucester County Infirmary, informs the *Lancet*, in reply to inquiries, that he has treated thirty cases of diphtheria (children and adults) with paraffine, and has had the satisfaction of seeing every one recover. His plan is to ask for the ordinary paraffine used in lamps, and, having scraped off the diphtheritic patch, to apply the paraffine every hour to the throat (internally) with a large camel's hair brush. As a rule, the throat gets well in from twenty-four to forty-eight hours, and with improvement in the throat the paraffine is applied less frequently, but he continues its use for two or three days after the complete disappearance of the patches. He speaks definitely as to the therapeutic effects, but is unable to state what the chemical action of paraffine on the diphtheritic membrane is; probably the hydrocarbons in the liquid exert some powerful influence on the membrane.

THERE are sixty miles of snow sheds on the Central Pacific Railroad.

"Bish" on Birds.

"Bish" says that "birds having long legs have to have a long neck."

"How's that, Bish?"

"Why, you see, if they didn't have a long neck, they couldn't drink without sitting down."

"Well, Bish, some birds have long necks and short legs. How is that?"

"You'll find these things are all calculated out. These birds having long necks have use for them. You are thinking about the swan. Well, he likes a bit now and then from the bottom of the water, and his long neck is to enable him to satisfy this taste; besides, long necked birds feed on food of a poor quality, so that to get any enjoyment out of eating, they have to have a long neck to enable them to taste it long enough to make it enjoyable."

"How about snipes?"

"Snipes! well, some of them haven't a very long neck, to be sure, but they have what amounts to the same thing—a long bill—and they are rigged so that they can tip up to make up for the rest. Now," said Bish, full of the long neck idea, "the ostrich has the longest legs of any bird I know. Look at his neck! It easily reaches to the ground. Doesn't this prove my position? And his legs are strong enough to hold up an elephant. Speaking of the elephant," continued Bish, "he isn't a long necked bird, I mean animal. He hasn't any neck at all, and he is so heavy that he can't sit down every time he wants a drink or a mouthful of hay. See how these things are calculated out for him. Could anything be handier than his trunk?"

"How about snakes, Bish?"

"All neck. They can reach anywhere for food or drink. Returning to birds," said Bish, "did it ever occur to you that birds that roost can't fall over backward?"

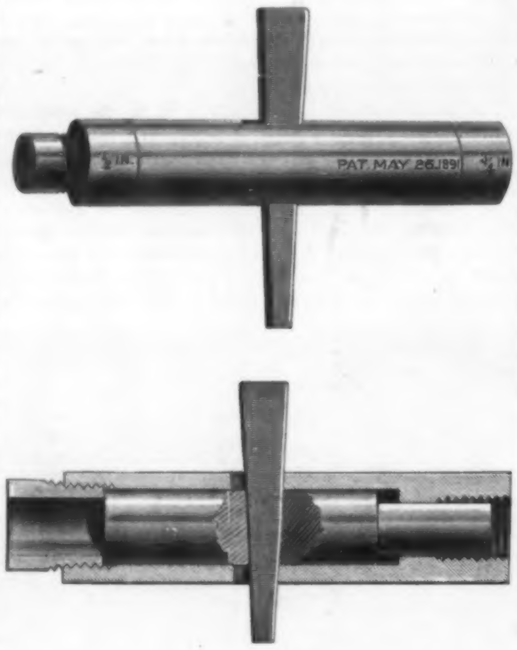
"No, indeed. How do you explain that?"

"Well, you see, their claws reach around the perch, so that when they begin to lean over backward, their claws tighten like a pair of pipe tongs. I tell you," said Bish, "these things are all calculated out."

PAINTED PAPER.—Unsized paper is coated with an aqueous solution of dextrin. When this coat is dry a layer of siccative oil paint is applied; and the sheet so obtained may be used for packing purposes, to render fabrics impermeable to water, etc.

NIPPLE HOLDER.

As shown in the accompanying cut, this holder is double ended and holds two sizes of nipples $\frac{1}{8}$ inch and $\frac{3}{4}$ inch. They are made in various sizes running from $\frac{3}{8}$ inch to 4 inches, and can be used in a machine or a vise. These holders are so arranged that when the thread is cut, the nipple can be removed by simply starting back the wedge. This loosens the inner part



NIPPLE HOLDER.

of the holder and allows the nipple to be easily taken out with the fingers. The sectional view shown in lower cut clearly shows the operation of the wedge. Formerly the nipple was driven in so firmly that after the thread was cut, wrench or tongs had to be used, which often broke or damaged the nipple. These holders are made by the Armstrong Manufacturing Company, of Bridgeport, Conn.

Chicago Fair Items.

Mr. James Dredge, editor of *Engineering*, London, and Sir Henry Trueman Wood, the Royal Commissioners for Great Britain and Ireland to Chicago's World's Fair, passed through New York last week homeward bound.

They had been to Chicago and selected a site for a building suitable for the British exhibits. The commissioners express their belief that our exposition will be the grandest that any nation has had and that their manufacturers will be well represented, notwithstanding their aversion to our tariff.

Mr. Steppani, of Berlin, wants to build a Moorish castle on the World's Fair grounds, and proposes to spend $500,000 on it. He exhibited a structure of this kind at Paris, but its cost was much less. The plans have been submitted to the Committee on Ways and Means, and if they are adopted visitors will certainly be dazzled by the Oriental magnificence of Mr. Steppani's palace. The building, it is proposed, shall be 200 × 200 feet, one story high, and constructed of brick in the Moorish style. Mirrors will make of the interior a place of brilliant and many times multiplied reflections. Indeed, one will be likely to lose himself in the maze of beveled and prismatic glass, for it is intended that a feature of the castle shall be a labyrinth where the illusions are to be so perfect that on entering one will think he is advancing to an endless series of colonnades.

Good Eyesight of Indians.

Dr. L. Webster Fox is of opinion that savage races possess the perception of color to a greater degree than do civilized races. In a lecture lately delivered before the Franklin Institute, Philadelphia, he stated that he had just concluded an examination of 250 Indian children, of whom 100 were boys. Had he selected 100 white boys from various parts of the United States, he would have found at least five of them color blind; among the Indian boys he did not discover a single case of color blindness. Some years ago he examined 250 Indian boys, and found two color blind, a very low percentage when compared with the whites. Among the Indian girls he did not find any. Considering that only two females in every 1,000 among whites are color blind, he does not think it surprising that he did not find any examples among the Indian girls.

THE NEW CHEMICAL LABORATORY CORNELL UNIVERSITY—THE LARGE LECTURE ROOM.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

ELECTRIC RAILROAD. — Ira Robbins, Sheffield, Ala. This invention provides a special construction and arrangement of parts for roads which employ a continuous insulated underground conductor for the supply of the current to the motor on the car. Spring-actuated drums, in boxes a proper distance apart beneath the roadbed, each carry a given length of conducting wire connected at one end to a carrier to be drawn along by the car, and connected at the other end to the main conductor, laid the full length of the line, the carrier being disconnected from the car when its section of wire is unwound, when it is drawn back and wound up on the drum by the spring, the car at the same time entering upon another section, and taking its current from the next carrier.

SNOW REMOVING APPARATUS.—James F. Seery, Kingsbridge, N. Y. This apparatus for clearing railway tracks and roadbeds of snow is mounted on a platform car, and consists of rotary brushes arranged to sweep the snow upon heated pipes or into a heated chamber, the snow that is piled on the pipes being carried along by auxiliary brushes and distributed over lower pipes, or thrown against pipes located above the lower coils. The snow is thus converted into heated water, which is delivered upon the roadbed in a manner designed to dispose of any snow which may have been left by the brushes.

CAR COUPLING.—Jeremiah W. Kirby, Great Falls, Montana. This coupler is of the "hook and catch" class, and is designed to be simple and durable in construction, and easy and efficient in operation. The drawhead has longitudinal recesses in its upper face, separated by a partition, and a transverse rock shaft carries lifting arms resting in the recesses, a coupling hook being pivoted at the rear end of one of the recesses and a catch bar arranged in the other recess. The coupling hooks have beveled heads whereby the cars will be automatically coupled as they come together.

Mechanical Appliances.

BLAST FURNACE BELL AND HOPPER. —Benjamin F. Conner, Columbia, Pa. This is an improved mechanism of simple and durable construction adapted to evenly distribute the charging material in the furnace, or to throw portions of it to the center only or to the walls as desired. An upper or outer bell closes the mouth of the hopper, and this bell has a central opening closed by a lower or inner bell, a counterbalanced beam above the hopper supporting the outer bell, while a lever connected with the inner bell is connected with the piston of a steam cylinder, an adjustable piston rod being adapted to engage the beam, the mechanism supporting and operating the bells independently of each other.

DRUM SHIFTER FOR HOISTS. — Jefferson U. Elwood, McKeesport, Pa. This device is adapted to slide the hoisting drum on the main driving shaft of a hoisting machine, to engage the drum with a friction pulley or other device for rotating it. It consists of a frame fitted to slide and having end plates, one of which engages the drum while the other has pins extending from its face and engaged by cam grooves in the face of a collar mounted to turn. The device is simple and durable, does not weaken the shaft in any way, and permits the operator to shift the collar either to the right or left to engage the drum with the friction pulley.

Miscellaneous.

FRUIT PICKER.—John H. Woodward, Rochester, N. Y. This is a simple and convenient device designed especially to facilitate the picking of grapes, by means of which the clusters may be readily separated from the vine, and will not be dropped, but will be held until they can be deposited in a suitable receptacle. It consists of a handled bar having a pointed end, a spring-pressed knife sliding on the upper side of the bar and a spring-pressed plate on the under side of the bar, the plate forming a stem clamp adapted to operate in unison with the knife.

PNEUMATIC GAME BOARD.—Edwin L. McConaughy, Philadelphia, Pa. This board, which is designed to be held in one hand in playing, is practically triangular in shape, and has a circular central depression, the level surface of the board sloping upward to the edge of the depression. Around the center are shallow cupped depressions, adapted to form resting places for a light ball of cork or other material used in playing the game, these depressions being connected by channels cut to form a track. In each of the depressions is a perforation extending obliquely downward through the board, and the ball is propelled by a jet of air from a simple form of bulb or other jet blower, the game requiring that the force of the jet shall be just sufficient to move the ball from one station to another till the central station is reached.

PNEUMATIC BILLIARD TABLE.—This is another patented invention of the same inventor, providing a game board with pockets or cavities consisting of cupped depressions formed in its surface, while the balls, of cork or similar material, colored as may be desired, are propelled by air jets from a jet blower. The blower is formed with a small nozzle adapted to fit in one of a series of apertures formed in the cushion wall around the board, and the game consists in propelling the balls to obtain the highest number of pockets with a certain number of air puffs.

METAL LATHING.—Charles H. Curtis, Niles, Ohio. This lathing is constructed of sheet metal having a series of openings running laterally and obliquely through it, leaving oppositely arranged hoods on reverse sides of the sheet, whereby a large body of mortar connects the outer surface portion of the plaster with the clinching portion, and but a small portion will pass through and fall behind the lath. The construction is designed to give special stiffness to the lath, on account of the corrugations being reversed, while the lath has superior locking qualities and is easily handled without cutting the hands, a sheet being adapted for putting on in any position, having no up or down, right or left, or front or back. The inventor has associated himself with the Niles Iron and Steel Roofing Co., of Niles, Ohio, who will manufacture this lath in addition to their line of roofing, corrugated and V-crimp iron, etc.

DUMPING WAGON. — Thomas Hill, Jersey City, N. J. Two patents have been granted this inventor for improved dumping wagons. In one of these wagons, on each of the side pieces of the wagon frame is secured a supporting rail of novel shape, the rail having a front and rear downward incline, with a higher central level portion in which are two recesses or sockets. On each side of the body of the wagon are two straps, each carrying a roller which rests and rides on the rail, their position being such that, when the body is at rest on a level, the forward rollers will be at the bottom of the front incline of the side rails, while the other rollers will rest in the sockets on the higher level of the rail, but when the body is pushed back the rear rollers roll down the rear incline and the forward rollers roll up and become seated in the sockets of the central higher portion of the side rails, whereby the wagon body is tilted rearward. According to the construction provided for by the other patent, the frame of the wagon curves downward at its back end, and on each side is a plate or rail forming a track, having a projection or stop at the rear end of its curved or inclined portion. On each side of the wagon body, somewhat nearer the front than the rear, is a strap to which is pivoted a roller carrier or carriage, the rollers running upon the side rails and carrying the body, which is tilted for dumping by being pushed backward till the rollers are arrested by the stop at the lower back end of the curved or inclined portions of the rails.

PLATFORM WAGON. — This improvement is covered by another patent to the same inventor, for a wagon more especially adapted for carrying heavy goods, the object being to lessen the cost of construction of such wagons, while making them lighter and better fitted to withstand the roughest usage. The main frame of the platform consists of two independent sections of angle iron, one of which, having opposite upper and lower flanges, forms the front and sides, and the other forms the back, which is bolted to the under side of the former. There is boarding in and between the flanges of the angle iron sections forming the front and sides, and re-enforcing strips within the channel between the boarding and the upper flange.

DISPLAY STAND.—Ernest A. G. Kurth, New York City. This stand can be readily taken apart and packed in a small space, and quickly built up, and is preferably adapted for the display of toys and other small articles, being also suitable for use as an ornamental center piece for a table. In the center of a circular base a polished brass disk is located, spanned by a yoke, and in apertures arranged in a circle around the base are inserted rods attached at their upper ends to a central connecting sleeve, and forming a cage-like figure, in which is a central vertical shaft, the lower pivot point of which turns on the polished disk. The shaft extends above the cage, where it has a hub with apertures in which are inserted curved arms adapted to receive articles for display, and the shaft also carries a fan wheel adapted to be rotated by currents of warm air ascending from lighted candles held in light rod brackets on the sides of the cage, whereby a portion of the stand will be kept constantly revolving.

KNIFE GUARD. — Charles S. Wright, Skaneateles, N. Y. This is a device especially designed for the use of retail dealers in cutting cheese. A circular plate or table, of sufficient size to hold the cheese, is pivoted on a suitable support, and centrally over the plate is secured an inverted U-shaped frame, adapted to extend centrally over the cheese. This frame is centrally connected with a bent and slotted knife guard extending at right angles from it, and having a suitable foot by which it is secured to the base. When the cheese is in position on the central plate it may be easily brought into position to cut a slice of any desired size, and when the cut is made the knife is guided at both ends to cut evenly through the cheese, so that there will be no crumbling or waste.

CANE JUICE STRAINER. — Walter C. Hazlip, Brusly Landing, La. This strainer may be operated by hand or power to effectually separate fragments of sugar cane and other refuse from the cane juice as it flows from the crushing rolls of a sugar mill. It consists essentially of an oblong juice-receiving box, on which is mounted a main strainer frame apertured at one side for the discharge of surplus juice, a reciprocating rake being actuated in the strainer, while a screen frame receives the overflow, and there is another screen frame lower down in the box.

WIRE STRETCHER. — John W. Peterson, Slater, Iowa. This is a simple and inexpensive device for stretching barbed or other wire, and facilitate the proper fastening of the wire to the fence posts. It consists of a bar having a fixed head at one end and a clamp and a fixed head at the other end, a lever and a hook sliding on the bar, with another clamp working oppositely to that of the fixed head, and other novel features, whereby the wire may be quickly and thoroughly stretched and held for attachment to the post, the device being also adapted for splicing wire.

CIGAR BOX TRIMMING MACHINE. — Henry Leiman, New York City. In this machine saw shafts are journaled in upper and lower adjustable brackets, the saws mounted on the shafts having lateral and vertical inclinations, in combination with a gauge bar, carrier, and other novel features, whereby the operation of trimming cigar boxes will be almost completely automatic, the mechanism of such machines being so simplified that the services of two unskilled laborers will be all the help required, their work being to feed the boxes to the machine, from which the box passes having all of its projecting edges made flush with its top, bottom and sides.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

Business and Personal.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(3497) W. F. E. asks: Can a practical and temporary storer or preserver of power be made with compressed air? If so, is there any limit to the amount of force that can be thus stored and used again at will? Are there any successful working appliances on this cold-pressed air plan? At what, and where? If not practical, why? Also are there any practical means of storing for a short time great quantities of mechanically developed electricity? A. Air under pressure can be stored for future use and is used in this way for mine haulage. It is limited to the size of storage tanks. Electricity is also, practically speaking, stored in the storage battery system. Has been described and illustrated in SCIENTIFIC AMERICAN and SUPPLEMENT.

(3498) F. J. S. asks: What pressure will a two by three foot upright boiler safely stand, one-half inch iron? What horse power and what size propeller will a boat five feet by twelve require to make a speed of four miles an hour? At what speed should a screw propeller (12 inch) be run for the best results? A. Small engines should have 22 cubic inches of cylinder space to a nominal horse power. Boilers should have not less than 14 square feet of heating surface to a horse power. Your boiler should be good for 100 pounds steam pressure. The boat requires 2 horse power engine and boiler. 12 inch screw should run 300 revolutions per minute.

(3499) S. A. K. asks: Can you tell me how to melt pure rubber and how to harden it again? A. You can soften rubber by heat and then it can be pressed into shape. It cannot be melted and hardened again. We recommend "Rubber Hand Stamps and the Manipulation of India Rubber," $1 by mail.

(3500) J. A. S.—For violin varnish.—Dissolve 12 parts sandarac gum, 6 parts shellac, 6 parts mastic, 3 parts elemi in 150 parts 95 per cent alcohol, in a bottle heated in a water bath. Then add 6 parts Venice turpentine. Stir and allow the contents to settle in the corked bottle. Then pour off the clear varnish for use.

(3501) W. P. asks: Can you inform me where I can find a magnetic needle for finding gold or silver deposits, and if there is such a thing? If so, the probable cost of one? A. There is no needle or other device for finding gold and silver. The ordinary dipping magnetic needle is used to indicate bodies of iron ore in the ground near the surface.

(3502) F. F. S. asks what the laundry people use to give the collars, shirts, etc., the gloss that is on them. A. 1. Starch, 1 ounce; paraffine, about 3 drachms; white sugar, tablespoonful; table salt, tablespoonful; water q. s. Rub up the starch with soft water into a thick smooth paste. Add nearly or quite a pint of boiling water, with the salt and sugar dissolved in it, and having dropped in the paraffin, boil for at least half an hour, stirring to prevent burning. Strain the starch and use while hot. Sufficient bluing may be added to the water, previous to the boiling, to overcome the yellowish cast of the starch, if necessary. Spermaceti may be used in place of paraffin. Starched linen can only be properly finished by hard pressure applied to the iron. 2. Glossed shirt bosoms.—Take 2 ounces of fine white gum arabic powder, put it in a pitcher and pour on a pint or more of water, and then, having covered it, let it stand all night. In the morning, pour it carefully from the dregs into a clean bottle, cork and keep it for use. A teaspoonful of gum water stirred in a pint of starch, made in the usual way, will give to lawns, white or printed, a look of newness, when nothing else can restore them, after they have been washed.

(3503) G. B. asks how to color leather black. A. Patent leather black.—Mix together ⅛ pound each of ivory black, purified lampblack and pulverized indigo, 3 ounces dissolved gum arabic, 4 ounces brown sugar and ¼ ounce glue, dissolved in 1 pint water; heat the whole to boil over a slow fire, then remove and stir until cool, and roll into balls. 2. Vinegar black.—This is the most simple and useful coloring liquid for the trimming shop for blacking leather straps. To make the simplest, and without doubt the best, procure shavings from an iron turner, and cover them with pure cider vinegar, heat up and set aside for a week or two, then heat again and set in a cool place for two weeks, pour off the vinegar, allow it to stand for a few days, drain off and cork up in bottles. This will keep a long time, and while producing a deep black on leather, it will not stain the hands. 3. 4·02 ounces bruised gallnuts and 17·5 ounces green nutshells are boiled in 26·25 ounces rainwater; when the mixture has boiled one hour; the liquor is strained through a cloth; the leather to be colored is first stained with the solution of iron filings, common salt and vinegar, as given under purple, before the above decoction is applied.—From "Scientific American Cyclopedia of Receipts, Notes and Queries." In press.

(3504) A. J. B. asks for a harmless hair dye. A. The following is a receipt for hair dyes taken from the "Scientific American Cyclopedia of Receipts, Notes and Queries." In press. Walnut skins beaten to a pulp, 4 ounces; rectified alcohol, 16 ounces. For a black dye the following is excellent. Iron sulphate, 10 grains; glycerin, 1 ounce; water, 1 pint. The hair must be thoroughly washed with this, dried and brushed once daily for three days, then the following should be applied on a small tooth comb, but it should not be allowed to touch the skin if the other preparation has done so, as a temporary stain would result. Gallic acid, 4 grains; tannic acid, 4 grains; water 1½ ounces. After the application of the first preparation the hair should be allowed to dry and then be brushed. Subsequently both formulas may be used once daily, at an interval of an hour or so, until a black color is produced.

(3505) E. K. asks for the general method of tanning fur skins. A. After cutting off the useless parts, and softening the skins by soaking in warm water, take away the fatty part from the inside, after which soak the skins in tepid water for two hours. Mix equal parts of borax, saltpeter, and Glauber salts (sulphate of soda) in the proportion of about ½ ounce of each, for each skin, with water q. s. to make a thin paste. Spread with a brush over the inside of the skin, applying more on the thicker parts than on the thinner. Double the skin together, flesh side inward, and place in a cool place. After standing twenty-four hours wash the skin clean, and apply the following mixture in the same manner as before: 1 ounce sal soda, ½ ounce borax, 2 ounces hard white soap, melted slowly together without being allowed to boil; fold together again and put in a warm place 24 hours. After this dissolve 3 ounces alum, 7 ounces salt, 1½ ounces saleratus, in sufficient hot rain water to saturate the skin; when cool enough not to scald the hands, soak the skin in it for 12 hours, wring out and hang up to dry. When dry, repeat the soaking and drying 2 or 3 times, till the skin is sufficiently soft. Lastly, smooth the inside with fine sand paper and pumice stone.—From "Scientific American Cyclopedia of Receipts, Notes and Queries." In press; ready December 1, 1891.

(3506) A. L. N. writes: Please inform me through your valuable paper the difference between open and closed circuits, also the difference in battery for open and closed circuits? A. In an open circuit the current flows over the wire only when the circuit is closed temporarily, as in ringing a bell or in operating a telegraph sounder, whereas in a closed circuit the current flows continuously over the wire except in the intervals produced in the regular signaling or telegraphing. For an open circuit, a battery which will not deteriorate under the conditions of use is employed, such as the Leclanche and many of its modifications. For a closed circuit a battery is employed which will maintain a continuous current so long as the battery is supplied with materials and kept in order. The gravity battery is the most generally used on circuits of this class.

(3507) J. F. C. asks: Give a practical receipt for keeping beef from spoiling for a long time in warm weather, without drying it. A. Canning and cold storage are the only means of preserving meat that we can recommend. The use of preservatives, such as salicylic acid, sulphites, boric acid, etc., is to be deprecated. The short article you refer to is not very accurate, but presents rather the popular aspect of the case.

(3508) C. M. H. asks: 1. Give rule for obtaining any desired speed with and without counter shaft. A. Rules for speed.—Multiply the diameter of the driving pulley by its speed and divide the product by the diameter of the driven pulley for its speed, or the required speed for the diameter. If a counter shaft is used, proceed in the same manner for its speed, and use its driving pulley as above for the final speed, or size of last pulley. 2. Give rule for obtaining any desired speed by gears. A. For gearing use the principle as above stated, but measure the gears by the number

of their teeth. 3. Can carbon after being burnt out of steel be brought back? If so, how? A. Steel can be decarbonized at a red heat, inclosed in an iron box and packed with pulverized hematite or iron anvil scales, and recarbonized by the same process, but packed in charred bone dust or hoof parings.

(3509) G. E. E. says: In crushing coke for furnace work there is a great deal of waste that passes through our one-half inch sieve. This is too fine to burn on a grate, as it chokes and will not allow the air to pass through. Will you kindly tell me through the SCIENTIFIC AMERICAN of some cheap way to stick this fine fuel together in lumps or bricks, so that I can burn it in a stove or furnace with draught not blast? A. You will find in SCIENTIFIC AMERICAN SUPPLEMENT, No. 360, description and illustration of a machine for compressing coal refuse into bricks or balls. A machine such as is used in making hard pressed brick would answer the purpose for the soft Illinois coal dust. A slight sprinkling of coal tar and heat with pressure will make solid fuel.

(3510) C. K. asks: 1. How far is it possible to hear thunder under favorable circumstances? A. Thunder is seldom heard over 12 miles, unless under very favorable conditions, when 15 miles is a probable limit. At this distance there would be a lapse of 72 seconds between the flash and the thunder. 2. Does a bullet fall at the instant it leaves the barrel, or does it rise before it begins to fall? A. The fall of a bullet is controlled by gravity, and it commences its downward curve at the instant of leaving the gun. The line of sight is not parallel with the bore, which gives the appearance of rising, which it does as referred to the line of sight.

(3511) T. T. E. asks: Will air getting into a small water service pipe prevent the water from flowing through it when the fall is at least 100 feet? The owner of my cottage claims it as a reason for my water supply stopping. I say I think if there was more air, that we should get more water. The water is caught from the spring in a large barrel and then conveyed through ½ inch lead pipes to several cottages then in small tanks with an overflow pipe. I am on the highest ground and am the first to be shut off. A. Air in the pipe is probably not your trouble. The supply pipe from the barrel is too small, so that when the water is running in the lower house tanks it weakens the pressure at your house; and stops the flow.

(3512) W. R. P. writes: Please give a receipt for a varnish to be used on gun stocks. A. Use shellac varnish and rub to a fine finish with French polish.

(3513) J. C. R. writes: We have a 50 horse power engine which we wish to increase to a 60 horse power. The cylinder is 12×18 and is making 180 revolutions per minute. How fast will it have to run to gain the desired power (10 horse power)? A. In the absence of full information concerning your plant, we can only advise an increase of steam pressure about 15 per cent, which will increase the speed to 200 revolutions and to the required power. If the boiler will not bear the increase in pressure and is large enough for additional supply, a change in the cut-off would be in order. Not knowing anything of the make of your boiler and engine, we advise that you address the makers as to the safest way of increasing its power.

(3514) L. F. writes: Will you kindly answer the following questions: 1. What is bisulphuret of tin? An old Olmstead's Natural Philosophy states that it is superior to amalgam for exciting the rubbers of a friction electric machine. I have inquired for it at several wholesale and retail drug stores, but they know of no such substance. Has it any other name? A. It is a compound of one atom of tin with two atoms of sulphur. Its formula is SnS_2. It is sometimes called mosaic gold. It may be made by heating a mixture of 12 parts tin, 6 mercury, 6 sal ammoniac and 7 of flowers of sulphur. It is sometimes used as a substitute for gold powder. 2. At what collegiate institutions in the United States is the doctrine of evolution taught? A. The doctrine is treated in the leading colleges, and in their biological courses quite fully.

(3515) R. B. W. asks: 1. What are the salts used in gold, silver, nickel and copper plating? A. In gold plating, the cyanide of gold, produced from chloride; in silver plating, cyanide of silver, produced from chloride; in nickel plating, double sulphate of silver and ammonia; in copper plating, cyanide of copper; and in electrotyping, sulphate of copper. 2. What kinds of anodes are used? A. Anodes of pure gold, silver, nickel and copper. 3. Can you inform me of some practical volume on plating? A. We refer you to Watt's "Electro-Deposition of Metals," price $3.50, also Urquhart's "Electro-Plating," price $2. 4. What numbers of the SUPPLEMENT contain articles on this subject? A. We refer you to SUPPLEMENT, Nos. 310 and 160. 5. In what numbers of the SUPPLEMENT can I find descriptions of various kinds of batteries? A. For information on batteries we refer you to SUPPLEMENT, Nos. 157, 158, 159, and 792.

(3516) J. W. K. says: Have you any articles on construction of shallow wells? Want to make a well for irrigation. Distance to water, 10 feet. The water is in gravel and sand. Can more water be taken from the ground by driven or open wells? A. The open well when properly constructed will give the most water, but the driven well system is the cheapest for obtaining a large supply. By driving a number of tubes some distance apart and connecting all together below frost line, a single pump will operate the whole system. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 107—110, for valuable illustrated articles on the drive well for small and large water supply.

(3517) F. B. W.—There is no process whereby cast iron can be toughened or made more lasting for car brake shoes. By partial chilling or by converting them into low steel.

(3518) N. B. D. says: I want some material of which to make moulds so that I can cast stereotypes of small jobs and lines of type. I want something in which I can make an impression of the type. Plaster of Paris cracks and sticks in the type, and I have no facilities for using stereotypers' paper. What can you suggest? A. We call to mind nothing better than paper or plaster. The latter will not crack if properly manipulated.

(3519) F. M. K. writes: Please give receipt for preserving wood from the effects of the weather and sun and rain, so as not to crack or absorb moisture. A. Use raw linseed oil for wood that is exposed to the weather. Oil and dry in the sun, two coats, and finish with boiled oil.

(3520) L. A. V. writes: A solid iron cylinder about 9 inches in diameter propelled by geared machinery runs on a solid iron track at each end. A cogged band driven on each end of the cylinder runs in a cogged track, the band being about an inch greater in its diameter to the outer edge of the cogs than the diameter of cylinder, and the cogged track being correspondingly lower than the face of the iron track on which the cylinder rolls. Since putting on the cogs they cause the cylinder to creep about 2 inches in moving 22 inches. Cogs work close. Now can this be remedied by dressing out the cogs on both band and track so they would work looser? A. You cannot stop the creeping by dressing the cogs. The cog band is too large; its pitch line should be of the same diameter as the cylinder, and the rack raised so that its pitch line shall be level with the bed plate face. The pitch line is a little larger than the center line of the teeth, so that the teeth will not bind.

(3521) J. W. H. says: I write to ask the composition of the material of rubber streets that are being put down in Berlin. Also if it would be suitable material for a race course for trotting horses, and what it would cost per square yard? A. We have no information as to the detail or composition used in the Berlin streets. Rubber is a very expensive material for such composition. The cheapest rubber mixtures made here cost about 20 cents per pound, or, if one inch thick, would cost about $8 per square yard. As to value for a race course, experiment would be necessary to determine.

(3522) E. P. and F. W. asks for a dressing to freshen up patent leather when it has become dull. A. Use common vaseline. Allow the vaseline to remain on the shoe for half an hour, then remove with Canton flannel.

(3523) G. H. asks: 1. When steaming wood for bending, can there be anything put into the water that will make the wood more pliable? A. We think of nothing better than the steam. 2. Is there anything that will take out stains and make the wood whiter. A. Chloride of lime, also oxalic acid for stains. Oxalic acid is a poison.

(3524) D. C. G. writes: I wish to make lead harder without losing any of its weight or ductility. Can I fuse together 1 part copper to 20 parts lead? How much heat would be required to melt the composition? Would remelting change the nature of the metal alloys? A. You can make an alloy as proposed. A small portion of copper will be taken up by lead when added in thin strips to the lead at a red heat. Tin will also make it a little harder. A little antimony will also harden, but makes it less ductile. The composition named will melt at 800° Fah.

(3525) R. A. J. writes: I wish to build a small water motor about nine inches in diameter. Have water pressure of 35 pounds and in using a three-sixteenths inch jet it reduces the pressure to twenty pounds. Is the jet too large? How many buckets should I put in such wheel, and about what size should they be? Will this motor give me sufficient power to run a sewing machine? A. You lose power by friction in the pipe; pipe should be larger; if not possible, the jet may be a little smaller. If the motor is well made, you can drive a sewing machine with it. You will require 30 buckets.

(3526) N. L. D. asks: What is the hardest composition which will adhere to wood firmly? I suppose cement would be the proper word to use. Is there any way of using iron filings, mixing with any substance which when pressed into a hole or groove in wood will make a surface as hard as sheet iron? A. Iron filings 3 parts, ground white lead and red oxide of iron paint 1 part each, and enough boiled linseed oil to make a stiff putty. Drive it into the hole or crack. It will become very hard when dry.

(3527) W. F. D. asks: What start or time allowance do you give a 14 foot sail boat over a 20 foot sail boat in a five mile race? A. The time allowance used by one of the New York yacht clubs for racing is as follows: Rule.—Time allowed in minutes per mile of course sailed equals the difference of the square roots of the lengths of the boats in feet, on the water line, and in favor of the smaller boat. In your case the longer boat equals $\sqrt{20}=4{\cdot}472$

shorter boat $\sqrt{14}=3{\cdot}741$

minutes per mile $0{\cdot}731$

course in miles 5

Time allowance $3{\cdot}655$

3 minutes 39·3 seconds.

(3528) L. S. C. says: I would like to know if there is any substance to put into a dip of acid water and blue vitriol that will make iron goods have a red color. A. The scale must be removed from the goods by dipping in a warm bath of muriatic acid 1 part, water 4 parts, then dip in a saturated hot solution of sulphate of copper, or they may be tumbled in saw dust wet with the sulphate. This will give them a thin coat of copper.

(3529) F. P. B. asks: How much water will a ½ inch pipe carry per hour 2,000 feet long with 200 feet of head? A. If the pipe is in good order, it should deliver 120 gallons per hour.

(3530) W. A. R. says: 1. Please inform me of some quick and cheap drier for paint. We use boiled oil, turpentine and oxide of iron. Would like some other receipt for making a cheap red paint. A. Use litharge, one-sixth the bulk of the iron oxide, as a drier. The cheapest red paint is Prince's metallic paint, composed mostly of oxide of iron. Mix with boiled oil and turpentine. Requires no drier for outside work. Is an excellent paint for iron work. 2. What is the horse power of an engine 10 inches by 12 inches, 150 revolutions at 60 pounds pressure? A. Your engine is 36 horse power, indicated, assuming that the cut-off is ⅝.

(3531) G. W. C. writes: 1. Please tell me the composition of celluloid and the process of manufacturing it? A. You will find a description of celluloid and its manufacture in SCIENTIFIC AMERICAN SUPPLEMENT, No. 227. 2. What is the best flux for welding cast steel? A. Use borax with 10 per cent sal ammoniac, pulverized, for welding steel. 3. What is the best to clean old paint from a carriage, so that it may be painted again and look like it was painted on new wood? A. You can blister the old paint off with blowpipe lamp such as used by painters and plumbers. Or you may rub down the old paint with pumice stone and water.

(3532) T. J. W. writes: Can you give me a formula for a cement of some kind that would fasten together rubber hose so that it would stand a water pressure of 40 lb.? What I am after is something strong enough so that you could taper one end and hollow out the other, so as to have it all uniform size and make a smooth job. A. The job you propose is difficult. You might try the experiment of wrapping two or three folds of gutta percha tissue around the tapered part, put the parts together and apply heat, pressing the parts together when the percha is well softened, clamp them and remove the heat. This would cement the parts, and if well done, the joint might stand. The heat need not exceed 200° F. Perhaps hot water within and without might be used as heating agent.

(3533) M. B. R. asks: Can you inform me if there is anything on the market which will remove type writing from paper without damaging the paper? A. Caustic soda, or some hydrocarbon such as turpentine or benzine, would be the only substances we would suggest for ordinary type writing. Hydrocarbons would be least likely to injure the paper.

(3534) H. B. W. writes: 1. What would you advise me to do to become a civil or mechanical engineer? A. Study hard. 2. Is a college education necessary to become a good engineer? A. In general, yes. 3. How much could be made at either of the above professions per year by a first class man? A. From $2,000 to $10,000.

(3535) L. A. F. writes: I desire to become an expert electrician. I have a good grammar school education. Can you inform me of a school where I can learn the practical part as well as the theory of electricity? A. You might write Cornell University, Ithaca, N. Y.; Stevens Institute of Technology, Hoboken, New Jersey; Rensselaer Polytechnic Institute, Troy, N. Y.; Mass. Institute of Technology, Boston, Mass.

(3536) J. P. writes: 1. As we have in this city a hydrant pressure of 80 pounds to the inch, I would like to make a small hydraulic motor, say 18 inches diameter fed by a one inch pipe. What form of motor will give me the greatest amount of power; what would be the horse power of such a motor with the size of wheel and feed pipe given above, and where can I get a description of or directions for making such? A. The value of your proposed motor would be about three horse power. You cannot do better than to look over the illustrated description of the impact wheels in SCIENTIFIC AMERICAN SUPPLEMENT, No. 454. 2. What power will be required to work a small pressure pump throwing a continual stream through a ⅝ inch pipe at a pressure of 400 pounds to the inch? Where can I find instructions for making such a pump of simple construction? What books have you which treat of hydraulics, especially as applied to motors and pumps, which would be suitable for an amateur who wishes to study the subject? A. It will require about 6 h. p. to run your pumps. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 788, 789, 791, 792, 793, 799, 805, for a complete series of illustrated articles on hydraulics or the power of water. We can also mail you "The Practical Hand Book of Pump Construction," by Bjorling, $1.50.

(3537) A. B. M. writes: In Fownes' (Watts) Chemistry, p. 414, I read: "Ferric salts are thus characterized. . . . Tincture or infusion of gall nuts strikes a deep bluish black with the most dilute solutions of ferric salts." Should not ferric be ferrous in the above? As I understand it, "green vitriol" is ferrous sulphate, and that certainly strikes a deep bluish black with tannin. A. Fownes' chemistry is correct. The dark color produced by "green vitriol" and gall nut infusion is due to some of the base being oxidized, which almost always occurs when the salt in question is dissolved in water exposed to the air.

(3538) J. M. S.—The paper is a chemical print or copy of a tracing from the original drawing. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 421, "How to Make Blue Prints." You can only keep grapes to best advantage in a cold room, at as low temperature as possible without freezing.

(3539) G. M. T. asks: How is the velocity of a bullet, as it leaves the gun or in any part of its course, determined? A. The velocity of projectile from cannon or rifle is measured by an electrical apparatus, one of which is illustrated and described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 177.

(3540) L. J. M. — A photophone is an instrument for transmitting speech by means of a beam of light. You speak against a thin mirror, causing it to vibrate; the light from the mirror is reflected and focused upon electrified selenium, which is sensitive to the light vibrations; and when a telephone is connected with such selenium, sounds are heard.

(3541) J. F. B. asks how to cleanse and whiten the bones of small animals. A. 1. The curators of the Anatomical Museum of the Jardin des Plantes, in Paris, have found that spirits of turpentine is very efficacious in removing the disagreeable odor and fatty emanations of bones or ivory, while it leaves them beautifully bleached. The articles should be exposed in the fluid for three or four days in the sun, or a little longer if in the shade. They should rest upon strips of zinc, so as to be a fraction of an inch above the bottom of the glass vessel employed. The turpentine acts as an oxidizing agent, and the product of the combustion is an acid liquor which sinks to the bottom, and strongly attacks the ivory or bone if allowed to touch it. 2. Make a thick paste of common whiting in a saucer. Brush well with a toothbrush into the carved work. Brush well out with plenty of clean water. Dry gently near the fire. Finish with a clean dry hard brush, adding one or two drops (not more) of sweet oil. 3. Take a piece of fresh lime, slake it by sprinkling it with water, then mix into a paste, which apply by means of a soft brush, brushing well into the interstices of the carving or skeleton; next set by in a warm place till perfectly dry, after which take another soft brush and remove the lime. Should it still remain discolored, repeat the process, but be careful neither to make it too wet nor too hot in drying off, or probably the article might come to pieces, being most likely glued or cemented together. If it would stand steeping in lime water for twenty-four hours, and afterward boiling in strong alum water for about an hour and then dried, it would turn out white and clean. Rubbing with oxide of tin (putty powder) and a chamois leather will restore a fine gloss afterward.—From "Scientific American Cyclopedia of Receipts, Notes and Queries." In press.

(3542) C. A. asks for a remedy for excessive perspiration. A. The following receipt is from the "Scientific American Cyclopedia of Receipts, Notes and Queries." Carbolic acid, 1 part; burnt alum, 4 parts; starch, 200 parts; French chalk, 50 parts; oil of lemon, 2 parts; make a fine powder, to be applied to the hands and feet; or to be sprinkled inside of the gloves or stockings.

(3543) E. R. writes: Lately cooling apparatus have been made for using over again the condensation water of ice machines (economy of water). The arrangement consists of a structure 15 m. to 20 m. long, 7 m. to 8 m. high, and 1·5 m. wide at the bottom and 0·80 wide at the top, and has 10 compartments, one above the other, which are filled with thorn (white or black thorn) like the Saliene hedges. The condensation water, which has a temperature of 20 to 25 R., is brought in and trickles down through the thorns and is caught in a receptacle. The water is cooled to a temperature below that of the atmosphere. When the temperature of the atmosphere was 13 R. = 16·25 C. = 61·25 F., I found the water cooled to 10 R. On the warmest days, when the atmosphere is at 18 to 20 R., the water which has trickled through is not more than 12 R., the water being 8 R. = 10 C. = 18 F. cooler than the atmosphere. The structures are set up in the open air, without any roof, and exposed to the sun. Why does the water become so much cooler than the atmosphere? A. The water is cooled by evaporation from the large surface made by trickling over the brush.

(3544) J. L. W. asks how to give a black coating to brass. A. 1. The dead black on optical instruments is produced by dipping in a solution of chloride of platinum. To make this, take 2 parts hydrochloric acid, 1 part nitric acid, mix in a glass bottle and put in as much platinum foil as the acid will dissolve when placed in a warm sand bath, or to hasten the solution, heat to nearly the boiling point of the acids. One-half ounce nitric and 1 oz. hydrochloric acid will absorb about 30 grains platinum, but in order to neutralize the acid, it is better to have a surplus of platinum. Dip the article or brush in the chloride. 2. Optical and philosophical instruments made in France often have all their brass surfaces of a fine dead black color, very permanent and difficult to imitate. The following, obtained from a foreign source, is the process used by the French artisans: Make a strong solution of nitrate of silver in one dish, and of nitrate of copper in another. Mix the two together and plunge the brass into it. Remove and heat the brass evenly until the required degree of dead blackness is obtained.—From the "Scientific American Cyclopedia of Receipts, Notes and Queries."

(3545) W. S. asks: Is a vessel made of galvanized iron suitable for keeping water for drinking? A. This is a somewhat debated question. If kept clean and if the water was pure and not allowed to stand long in the vessel, we should consider it safe, but as neglect might result in making the water poisonous, we should recommend the use of tin in preference. Soluble compounds of zinc are poisonous. For a note on the subject we refer you to our SUPPLEMENT, No. 807.

(3546) W. B. K. writes: Please give me a receipt for bicycle enamel and tell me how to polish nickel and enamel. A. Use japan varnish on your bicycle. It should be heated in an oven to be dried. Polish nickel with chalk. Also see Query 3548. Rub the enamel with French polish.

(3547) D. W. says: Kindly inform me of a powder or paste for cleaning and polishing copper and brass. A. Tripoli, or rottenstone, mixed with a solution of oxalic acid in water makes a very good polishing material. The addition of a little glycerine will keep it soft as a paste. Also see Query 3548.

(3548) J. A. L. T. asks: 1. Give a receipt for cleaning mica that has been used for lights in the doors of stoves and become discolored by heat and smoke. A. Use hydrochloric acid with stiff brush. If the acid touches the iron of the stove, it will begin to dissolve it, and produce rust stains. You might try kerosene oil applied with a rag just moistened with it. 2. The composition of a substance which is used for polishing metal surfaces, such as plated table ware, which is now in use, and which has the odor of bitter almonds and which odor it is said cannot be got rid of. A. Oxalic acid, 1 part; iron peroxide, 15 parts; powdered rotten stone, 20 parts; palm oil, 60 parts; petrolatum, 4 parts. Pulverize the oxalic acid and add rouge and rotten stone, mixing thoroughly, and sift to remove all grit; then add gradually the palm oil and petrolatum, incorporating thoroughly. Add oil of myrbane or oil of lavender to suit. By substituting red ashes from stove coal, an inferior imitation of the foregoing paste will be produced. The original article is known as putz pomade.—From "Scientific American Cyclopedia of Receipts, Notes and Queries." In press, ready December 1.

(3549) E. W. M. writes: We have several large plunge batteries for running a motor, and after the solution has been in the cells a long time, the salts settle in the bottom, and we find that it is very hard to remove without breaking the glass jar. Will you please give us a good way to clean the salts out without breaking the jar? A. By filling your cells with water and inverting them in a vessel of water, the salts in the bottom of the cells will be readily dissolved out.

(3550) C. H. C. writes: 1. I have 14 ft. boiler, 54 in. shell, sixty 3 in. flues, 24 in. diameter smoke stack, 60 ft. high; rocking grate 54 in. wide by 37 in. deep to bridge wall; engine 10 by 12, speed 180. The draught seems defective, combustion imperfect, consumption of fuel, mostly shavings (some soft coal), excessive, and very hard firing, boiler new. Can you tell me wherein lies the trouble or defect, and suggest a remedy? A. Your boiler and engine appear to be well balanced as to power, but the smoke stack is too small for burning shavings, and probably the fire chamber is too small and not arranged for burning shavings and soft coal. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 624, for illustrated lecture on boiler furnaces for various kinds of fuel. 2. Name one or two best works, in plain, simple language, on construction, setting, management, or firing modern steam boilers, with price. Several I have are too English and too algebraic for the simple mind of my engineer. A. "Useful Things to know about Steam Boilers," by Tower, $2 mailed; also "Steam Making or Boiler Practice," by Smith, $2.50 mailed.

(3551) E. S. asks: How to make a cement which will mend broken minerals, etc. A. 1. Use best fish glue (hot) and tie well. 2. Starch, ¼ oz.; white sugar, 1 oz.; gum arabic, ¼ oz. Dissolve the gum in a little hot water, and the sugar and starch, and boil until the starch is cooked.—From the new "Scientific American Cyclopedia of Receipts, Notes and Queries." In press.

(3552) H. A. A. asks: 1. In making the "Simple Electric Motor," described on page 497, "Experimental Science," does it matter if I use three or four pieces of wire for the armature core, the ends not being joined? A. It is immaterial how many pieces of wire you use in the construction of the core of your armature. 2. Would not No. 20 or 22 wire do for winding the armature? A. Yes; provided you use a current adapted to such winding. 3. If the brush-holding disk is made so that the brushes may be placed in different positions, would it not make the motor run at different speed? A. Yes; but this method of regulating a motor is not economical.

(3553) A. M. asks what platinum silver is? Is it platinized silver? A. Platinum silver is an alloy consisting of platinum 1 part, silver 2 parts.

(3554) F. D. asks for a receipt for making a paste for bill posting and paper hanging of all kinds, that will not freeze or get thick in the winter, or tell me where I can get the prepared paste or the materials for making same. A. All ordinary paste will freeze when subjected to a freezing temperature. Make your paste of good flour mixed smoothly with cold water to a thin creamy consistency. Cook over a water bath until it thickens, but remove it from the water bath before it begins to look clear. When nearly cold add from five to ten per cent of alcohol. Also twenty drops of oil of cloves to every gallon of paste. The alcohol prevents freezing, and the oil of cloves prevents it from souring.

(3555) W. F. B. asks if there is any such thing as soluble beeswax, and if so, the formula for making it. If not, could you tell me how I could prepare beeswax, so that I could use it with a small brush to paint letters on brass to etch? A. Beeswax can be dissolved in turpentine, and the fixed and volatile oils. It dissolves in 35 parts of ether and 11 parts of chloroform. The last solution would be suitable for your purpose.

(3556) Librarian asks if there is an article which will restore the color to faded black book covers. I have heard that ether is useful, but hesitate to use it or anything else, except on authority. A. The agent to use, if any can be successfully employed, depends on the nature of the color. A solution of an iron salt in water might be of use, but any such application would tend to impair the finish of the leather. We should advise the use of nothing except bookbinder's varnish, which might be blackened by the addition of nigrosine or aniline black.

(3557) F. R. W. asks if there is any preparation or fluid that I can print or write with that will change its color on being moistened. Or is there any preparation that I can use to make a very delicate or invisible line with, and on being moistened will show up very plain? A. Write with an aqueous solution of tannin, using a gold or quill pen. Develop by moistening the writing with a weak solution of sulphate of iron. The writing when developed will be nearly black.

(3558) J. H. S. writes: I desire to know whether a cellar can be so constructed as to keep out the water; if so, how? The cellar in question is now built, but will not keep out water, though well cemented. A. A cellar can be constructed so as to be waterproof, if the bottom or floor is first covered with cement, the walls built thereon laid in cement, and the exterior of the wall covered with cement. This makes, practically, a watertight basin. The cement used must be the best Portland cement one part, clean sharp sand one part. After a cellar is built it is not so easy to make it waterproof. Still it can be done. Cover the exterior of the wall with the above cement, ditto the bottom, and work the cement in under the bottom of the wall. If these directions are followed, you will succeed. But if cheap materials are used and the work badly done, you will be sure to fail. A drain put around the outside of the wall or even inside below the cellar floor may be efficient in carrying off the water, if you can give it a good delivery.

(3559) G. A. asks: 1. How high a vacuum will the best piston air pump obtain? A. Within a very small fraction of an inch of a perfect vacuum, as measured by a mercurial gauge. 2. What kind of air pump is used to make the vacuum in incandescent lamps? A. A piston air pump driven by power is often used for the first exhaustion followed by a mercurial pump. 3. How long does it take to make the vacuum? A. No exact time can be given; it depends on the relative size of the lamp or lamps and pumps. 4. Is there any difference between an air pump and a vacuum pump? If so, what? A. No. 5. What motive power is generally used in large establishments, to work vacuum pumps? A. The descent of mercury. 6. Does salt dissolve more rapidly in cold than in warm water? A. No. 7. What is the ratio of relative brightness used in classifying stars into their different magnitudes? A. The relation of the brilliancy of a star of a certain magnitude and that of the magnitude immediately preceding has been variously determined from 0·346 to 0·464. Zollner (1865) from magnitudes 1 to 6 gives 0·363, and Rosen (1869) from magnitudes 5 to 9·5 gives 0·398. For an excellent and fully illustrated treatise on mercurial air pumps, we refer you to our SUPPLEMENT, Nos. 629, 630, 631.

(3560) H. W. B. asks: 1. What is the E. M. F. of the small dynamo described in SUPPLEMENT No. 161, when provided with the drum armature described in SUPPLEMENT, No. 599? Also what fraction of a horse power is required to drive it? A. The E. M. F. of the dynamo referred to is 12 volts. We do not know that the current from the armature described in SUPPLEMENT, No. 599, has been measured, but it is considerably higher than that of the armature described in SUPPLEMENT, No. 161. 2. What is the E. M. F. of the machine described on page 499 of "Experimental Science," when wound with finer wire and used as a dynamo? Also what fraction of a horse power is required to drive it? A. It would be impossible to tell what the E. M. F. would be without knowing what changes have been made. The difference of one size in the wire makes a great difference in the E. M. F. About ⅛ of a horse power will be required in each case.

(3561) H. B. M. writes: 1. Will you kindly inform me how a strong aqueous solution of tannin can be rendered colorless without detriment to its chemical properties? A. Use the purest tannic acid and pure water. If this is not satisfactory, agitate with ether, and on standing the ether will rise to the surface, carrying much of the coloring matter with it. Draw off the lower solution for use. 2. Also the same inquiry as to the sulphate of iron. A. Dissolve carefully scraped bright crystals of ferrous sulphate (copperas) in water, covered with a thin layer of olive oil. This will give a nearly colorless solution. In neither case must you expect a strong, absolutely colorless solution.

(3562) W. L. V. says: One candle is 8 feet in height and 1 foot in diameter. Another candle is 8 inches in height and 1 inch in diameter. Their wicks are proportionate. Will they both burn the same time, or will the larger one burn the longer time? Give reason with answer. Is the focal distance of a lens increased or diminished by the density of the atmosphere? A. The small candle contains 6¼ cubic inches. The large candle contains 10,848 cubic inches, and would require 1,735 wicks of the size of the small candle to consume it in the same time. The focus of a lens varies with the density of the atmosphere, but too small for observation.

(3563) J. E. B. asks whether the armature to motor described in SUPPLEMENT, No. 641, has to have 12 coils. Can I make it with 8 coils? What size wire required? A. An armature with 8 coils will work, but as a rule the more coils used, the better. The size of the wire depends on the current used. For a battery current such as is recommended, No. 18 wire will answer.

(3564) E. J. B. asks (1) how to cover wood pulleys for making polishing and emery wheels. A. The best plan for making an emery wheel with a wooden core is to cover the wood with sole leather which contains no oil. The leather can be fastened with glue and shoe pegs. After the glue becomes dry the leather should be turned off and made smooth with sandpaper. It should then be coated with the best white glue and immediately rolled in the emery, which should be warm. When the wheel is dry, brush off the surplus emery. 2. Also how to make a straight magnet, same as magnet used in Bell telephone receiver. A. Harden a bar of steel at the ends, draw it to a purple and magnetize in a coil through which a strong current is passing.

(3565) F. S. asks for a receipt for manufacturing soldering flux for tin. A. We give two receipts: *a*. Dissolve 1 part lactic acid and 1 part glycerine in 8 parts of water. *b*. Melt together 1 pound olive oil, 1 pound of tallow, and 8 ounces resin. While the mass is still fluid, but has cooled a little, add with constant stirring ½ pint of water saturated with sal ammoniac.

(3566) W. S. M. asks: How many guns did the Monitor use in the engagement with the Merrimac? A. Two 11 inch guns.

(3567) F. D. S. writes: I want to pump up an elevation of six feet, at the rate of 8,200 cubic feet per minute. Would like to know how much power will be necessary, and the best kind of pump to use? A. You will need a pump indicating 125 horse power, and would require two water cylinders each 6 feet in diameter, and 8 feet stroke, if single acting.

(3568) Dr. A. D. asks the quantity in weight or in bulk of carbonate of ammonia used to raise one pound of flour. A. About one teaspoonful should suffice for one to one and a half pounds of flour. It is not generally used.

(3569) R. G. asks: Why do engineers multiply the square of the diameter of cylinder by the decimal 0·7854 to find the horse power of steam engine? If the steam pump will draw water 33 feet at sea level, how far will it draw when the elevation is 8,000 feet above sea level, and how much should the suction be shortened for every 500 feet from 8 000 to 12,000 ft. H? A. The square of the diameter in inches multiplied by 0·7854 equals the area of the cylinder in square inches. At 8,000 feet the greatest height of pump lift is 23 feet. At 9,000 feet, 22 feet. At 10,000 feet, 21 feet. At 11,000 feet, 20 feet. At 12,000 feet, 19¾ feet. At 13,000 feet, 18¾ feet.

(3570) J. W. M. writes: I would like to have you give a receipt for a paste for sticking labels on to tin. I have tried a number of receipts, but they are all a failure excepting I use an alkali or acid, either of which will injure colored labels. What I want is a glue, cement, or paste that will stick paper colored labels to highly polished tin and nickel. A. To 2 tablespoonfuls of the best flour add a tablespoonful of brown sugar and a few drops corrosive sublimate, the whole to be boiled and continually stirred, to prevent its getting lumpy, till of the right thickness. To prevent mouldiness add a few drops of some essential oil, as oil of cloves.

(3571) A. V. S. writes: A young student of mechanical engineering would like to know a few of the most common causes of boiler explosions, and if any other gas than steam is ever the cause of explosions, and if there is always an explosive increase of pressure at the moment of explosion. A. You will find interesting and valuable information on boiler explosions, their cause and remedy, in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 463, 456, 581, with illustrations.

(3572) R. M. asks: Please give me a preparation of white ink that will adhere to a glazed card and not be easily washed off? A. Use zinc white or white lead, rubbed up with gum water to the proper consistency.

(3573) J. M. B. asks whether land will become enriched or impoverished if kept bare of vegetation. A. Land becomes impoverished and leached of the necessary constituents to vegetable growth by being kept bare of vegetation. The soluble elements of vegetation, carbonic acid, ammonia, phosphoric acid, potash, soda, sulphuric and hydrochloric acids, forming part of the constituents of vegetable life, are kept in circulation by a constant growth of vegetation. An unfed soil becomes barren from exhaustion from leaching, as it will also from overcropping, without artificial restoration of the elements withdrawn, which are necessary to sustain vegetable life.

(3574) P. W. asks: What is the best preparation to cover wood, to prevent horse manure from rotting it? A. Two coats of hot coal tar put on when the wood is dry.

TO INVENTORS.

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